

SCIENCE

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THE ITHACA MEETING OF THE AMERICAN PHYSIOLOGICAL SOCIETY.

THE tenth annual meeting of the American Physiological Society was held at Cornell University, December 28 and 29, 1897. Owing to a variety of reasons, but largely to the facts that since the last annual meeting the Society held in May a very successful special meeting in Washington in conjunction with the Fourth Medical Congress, and that its members took an active part in the proceedings of the Toronto meeting of the British Association for the Advancement of Science and the Montreal meeting of the British Medical Association, the attendance at Ithaca was not so large as usual. An enjoyable 'smoker' was held on the Monday evening preceding the meetings, at which the members of the Society received many of their friends from the other Affiliated Societies. Formal sessions for the presentation of papers and the transaction of business were held on Tuesday and Wednesday forenoons; Tuesday afternoon was devoted to demonstrations; and on Wednesday afternoon the Society took part in the joint meeting of the Affiliated Societies.

A matter of unusual interest was the presentation of the report of the committee on publication of the proposed physiological journal. This committee consists of Professor Bowditch (Harvard), Chittenden (Yale), chairman,

Howell (Johns Hopkins), Lee (Columbia), Loeb (Chicago), Lombard (Michigan) and Porter (Harvard), and its report consisted of an account of its labors during the preceding six months. These labors culminated in the establishment of a new journal, *The American Journal of Physiology*, the first number of which was presented to the Society. This publication is the outcome of a feeling of the need of ready means of publication, long held by American physiologists. It will be issued under the auspices of the Society, with about one volume a year, and with the above committee as the board of editors. It will be devoted solely to the publication of the results of original researches in physiology and allied sciences, and is issued in an unusually attractive and serviceable form, with Ginn & Company as publishers. The Society passed a vote of thanks to the committee, and especially to Professor Porter for his zealous labor in behalf of the new publication.

A communication from Drs. John W. Graham and H. Sewall, of the local committee for the Denver meeting of the American Medical Association, was presented, inviting the Society to attend the coming meeting of the Association in June. Professor Sherrington (Liverpool), on behalf of the British physiologists, sent a cordial invitation to the Society to take part in the proceedings of the International Physiological Congress in Cambridge, England, in August, 1898.

One year ago, at the suggestion of Dr. S. Weir Mitchell, a commission was organized by the Society to investigate the physiological properties of the edible and poisonous fungi. This commission now consists of Professors Chittenden (Yale), chairman, Abel (Johns Hopkins), Pfaff (Harvard) and Bowditch (Harvard). During the past year it has inaugurated work in several laboratories, and the results of this work were in part presented at Ithaca. Profes-

sor L. B. Mendel (Yale) reported his researches upon the composition and nutritive value of some edible American mushrooms. Chemical analyses were combined with experiments in artificial digestion, and special attention was given to the amount of available (digestible) proteid present. The latter was found to be not over two or three per cent. in fresh mushrooms, which shows that the prevailing idea of the great nutritive value of mushrooms is not yet justified. They may be valuable as dietetic accessories, but they do not deserve the term 'vegetable beefsteak.' Their nitrogen is largely in the form of non-proteid bodies. The amount of fat, cholesterin, soluble carbohydrates, crude fiber and inorganic substances contained in them corresponds in general with that found in other vegetable foods, such as peas, corn and potatoes. Professor Chittenden reported the results of some preliminary experiments upon the toxicity of some species of poisonous mushrooms, made by Dr. W. S. Carter (University of Texas). In view of the great interest now shown in the edibility of mushrooms, the investigations of the commission, which are being actively continued, will prove of immediate practical value.

A number of papers on physiological chemistry from the Yale laboratories were presented. Professor Chittenden gave the results of a study of the variations in the amylolytic power of the human saliva and their relation to the chemical composition of the secretion. Saliva collected before breakfast is stronger in amylolytic power than that secreted after breakfast. Similarly, the alkalinity of the former (due to alkaline phosphates and indicated by lacmoid) and its acidity (due to acid phosphates and indicated by phenolphthalein) are greater than the same properties in saliva collected after breakfast. The greater amylolytic power is due not to the greater

alkalinity, but to the greater concentration of the secretion coming from glands that have been resting. Stimulation of the mucous membrane of the mouth-cavity by the vapor of ether or chloroform, or by alcohol, whiskey or gin causes a secretion richer in digestive power and solid matters than that caused by mechanical stimulation. Professor Lusk presented experimental evidence for the view that in acute fatty degeneration the dextrose that is formed from proteid in the cell is converted into fat. Professor Mendel reported preliminary experiments on the quantitative variations in the excretion of kynurenic acid.

Upon invitation Professor W. Hallock (Columbia) gave an account of his researches with Dr. F. S. Muckey on the action of the larynx in the production of voice. The larynx is essentially a string-, not a reed-instrument. In the correct mode of voice-production, pitch is controlled by the intrinsic laryngeal muscles, and registers should be absent. Registers result from the action of the extrinsic muscles interfering with the proper action of the intrinsic muscles and causing a distortion of the larynx. The authors have analyzed tones by photographing the movements of sensitive flames, and have verified in general the conclusions of Helmholtz and König regarding quality. The chest, antra and sinuses do not act as resonance-chambers to reenforce the tone.

Dr. S. J. Meltzer (New York) demonstrated a new method of anesthetizing animals by ether administered through the rectum; a new pleural cannula *in situ*; and a simple method for the redistension of the collapsed lung. Professor Porter (Harvard) demonstrated, for Mr. F. H. Pratt, the isolation of the heart of the cat and its nutrition. A short glass tube was tied into the right ventricle of the excised heart. When a little defibrinated blood was poured in, contractions proceeded as normally.

Professor W. Patten (Dartmouth) outlined a new theory of color vision, based on the structure of the retinal cells in invertebrates. According to his observations, the structures in the eyes of invertebrates corresponding to the rods and cones of vertebrates are generally composed of groups of simple or compound wedges, containing a system of transverse fibrils accurately graded in length, according to their position in the wedges. The fibrils are always arranged in planes at right angles to the rays of light. All the fibrils in these planes may be parallel to one another, or at varying angles, or they may radiate from the axis of each rod, like the bristles in a test-tube cleaner, so that no two fibrils in the same plane are parallel. By assuming that the length and angular relations of a fibril determine the amount of its response to a wave of light of a given length and plane of vibration, it is possible to offer a logical explanation of many phenomena of color vision.

Professor G. P. Clark (Syracuse) gave an account of work that he had recently carried on with Professor von Frey, of Leipzig, upon certain characteristics of the pressure-sensations of the human skin. This dealt especially with the relations between the sensations caused by pressure and those caused by pull or traction. It was found, among other things, that the points most sensitive to pressure are also most sensitive to traction, that fatigue for the former stimulus is fatigue for the latter, and that the strength of the stimulus, the rate of application, the size of the surface and the locality of the skin to which the stimulus was applied, bear the same relation to the effectiveness of the two kinds of stimuli. The inference is that the two are mediated by the same sense-organs.

Professor Porter (Harvard), in behalf of Professor Bowditch, reported further observations by Mr. W. B. Cannon, upon the

movements of the œsophagus and stomach. The ingenious method, mixing food with subnitrate of bismuth and observing the process of swallowing and the movements of the stomach by means of the X-rays and the fluoroscope, had been announced previously. The details of the movements were described.

Professor Porter, who has been engaged for several years upon an experimental study of the mammalian heart, presented the results of his latest work. Among other things he described an ingenious method which he had devised for the study of the currents of blood in the root of the aorta. A small cylinder, made of hen's feather covered with lead foil, is fastened by a very short silk tether to the end of a probe, which is passed through the carotid artery and aorta down to the semi-lunar valves. The cylinder is so constructed as to have the same specific gravity as the blood. Its movements accordingly do not differ from those of an equal mass of blood. The lead foil makes the cylinder opaque to the Röntgen rays, so that its movements may be seen with the fluoroscope after the removal of the ribs. Thus the direction of the currents of the blood in the aorta is made visible.

Mr. F. W. Barrows discussed the results of his experimental studies on the effect of inanition on the structure of nerve-cells. In famished rats a decided shrinkage in the size of the cells and the nuclei was observed, and a still greater shrinkage in the nucleoli. The cells stain faintly with osmic acid, and the protoplasm shows a fine vacuolation. The general effects are similar to those produced by intense activity.

A number of papers were read by title in the enforced absence of their authors. At the joint session of the Affiliated Societies, Professor J. Loeb (Chicago) represented the physiologists in a paper entitled 'The

Physiological Problems of To-Day.' This has already been published in *SCIENCE*, p. 154.

A revised constitution was adopted by the Society. The project for a catalogue of physiological literature by the Concilium Bibliographicum of Zürich was presented by Professor Porter. The cordial thanks of the Society were extended to the authorities of Cornell University for the many courtesies shown during the meeting.

FREDERIC S. LEE,
Secretary.

COLUMBIA UNIVERSITY.

AMERICAN MORPHOLOGICAL SOCIETY (II).
Preliminary Notice of a New Species of Endoproc — Lozosoma Davenportii — from the Massachusetts Coast. W. S. NICKERSON.
(Read by title only.)

The specimens upon which this notice is based were found in Cotuit Harbor, Mass., and, as they differ in several important respects from any species hitherto found, it is proposed to describe them under the name *Lozosoma Davenportii*. The specimens were about two millimeters long. Each had a cylindrical stalk or foot, which passed without abrupt transition into a slightly expanded body containing a U-shaped digestive tube, etc. The body terminated at its free end in a lophophore carrying from eighteen to twenty-seven tentacles. The foot was destitute of a lateral expansion and of a foot gland, such as are found in several other species of this genus. Buds occurred attached to the anterior side of the body, nearly over the junction of the œsophagus with the stomach. Ovaries were present in all the individuals, but testes could not be found. Whether the species has separate sexes or is protandric must be left undetermined. There are three characteristics in which *Lozosoma Davenportii* differs markedly from other species of this genus. The first of these is the possession of a single

row of large cells lying in the wall of the body and extending along the mid-dorsal line from the base of the stalk to the vicinity of the arms. A second but not invariable characteristic is the presence of one or more flask-shaped organs attached to the wall of the body near the basal end of the stomach and projecting slightly forward. The third characteristic is a modification of the epithelial wall of the vestibule shown by those individuals which have developing larvæ, and consisting in part of irregular, tongue-shaped projections, whose free ends may be invaginated and filled with a yolk-like material. This substance may float out into the vestibule. The modified epithelium, as well as this yolk-like substance, forms a source of food for the developing larvæ.

Pleurivalent Spermatids and Giant Spermatozoa and their Relation to the Centrosome Question. F. C. PAULMIER. (Presented by E. B. Wilson.)

AMONG the spermatids in *Anasa tristis* occasionally occur those whose nuclei are double or quadruple the usual size, the cell body being correspondingly enlarged. While otherwise normal, the double ones have two centrosomes and two axial filaments.

These giant spermatids are due, the double ones to the non-completion of the second spermatocyte division, the quadruple ones to the non-completion of both divisions.

In the normal univalent spermatid the single centrosome persistent throughout the period of spermatocyte growth and division apparently disappears and comes into view later upon the other side of the nucleus. Is this disappearance real or only apparent?

In the bivalent spermatids the two centrosomes of the second division apparently disappear and two reappear at a later stage in the Nebenkern. In the quadrivalent

ones the four centrosomes of the first division (the original two having divided early in preparation for the second division) apparently disappear, and later four appear in the Nebenkern.

This fact that the same number of centrosomes which disappear—namely, two or four—always reappear seems to prove that the disappearance is only apparent and indicates that the centrosome persists in some form, perhaps hidden by the chromatin.

The Maturation of the Egg under Different Conditions. A. D. MEAD.

THE behavior of the *Chaetopterus ovum* when subjected to different conditions shows that many of the phenomena of maturation and karyokinesis, which usually appear to be correlated with one another, are in reality independent.

When the egg is allowed to remain unfertilized in normal sea-water the maturation proceeds only as far as the metaphase of the first spindle. When, however, the egg is (a) fertilized with one spermatozoon, (b) fertilized with several spermatozoa, or (c) placed unfertilized in a solution of potassium chloride, the polar globules are extruded in a perfectly regular and uniform manner, and certain characteristic changes in the contour of the egg take place in all.

Although these phenomena are the same, the appearance of the greater part of the cytoplasm of the egg is widely different in the various cases. To illustrate: The formation of the second polar globule, the reconstitution of the egg-nucleus and its migration toward the egg center, occurs in the same manner whether (a) the egg contains a sperm-nucleus and one huge sperm-amphiaser, whether (b) it contains a number of sperm-nuclei and sperm-amphiasers, or whether (c) it contains no sperm-nucleus or radiation in the cytoplasm.

Some Activities of the Polar Bodies in Cerebratulus. E. A. ANDREWS.

It is well known that some one-celled animals form 'filose pseudopodia,' that is, temporary, fine threads of flowing sensitive protoplasm. These serve for locomotion, taking-in of food, tactile organ, etc., *i. e.*, for relation with environment.

A recent statement that the cells and polar bodies in sea-urchin and starfish eggs put forth similar threads and so establish amongst themselves temporary living connections led the speaker to examine other animals. Filose phenomena were seen in the living eggs of an Annelid, a Gasteropod and a Lamellibranch, while preserved vertebrate material indicated their presence there also.

In the large Nemertian worm, *Cerebratulus lacteus* Verrill, the filose activities of the polar bodies are less difficult to see than those described in Echinoderms, and differ characteristically from them. Diagrams made from a series of camera drawings covering several hours' continuous observation showed that the polar bodies are very active in change of shape and in filose protrusions.

Each polar body has its special habit of action. In each there is a progressive specialization of activity. The polar bodies look not unlike Radiolarians, and when the second becomes of a spindle shape, with stars of filaments at its poles, it suggests the amphister stage in karyokinetic cell-division. This resemblance, so far as the star-like groups of filaments are concerned, is not superficial, if we accept* the statement that the astral rays in the starfish egg are often delicate, filose extensions of the contractile protoplasm between vesicles of an emulsion that makes up the egg; for then the internal stars and external stars are both expressions of the same contractile power and filose habit of protoplasm. Thus the filose powers of protoplasm are shown to

us through various striæ, filaments, rays and threads within cells, as well as through those hitherto unsuspected, delicate, flowing, thread-like, pseudopodial extensions external to, and amongst, the cells of Metazoan masses.

The Effect of Salt Solutions on Unfertilized Eggs of Arbacia. T. H. MORGAN.

If unfertilized eggs of *Arbacia* are put into sea water, to which 1.5 per cent. sodium chloride has been added and left there from one to three hours, they will, when returned to ordinary sea water, begin to segment after about half an hour. The division is sometimes into two parts, oftener into more than two parts, and does not in any way resemble the normal cleavage. These eggs continue to divide for at least twelve hours, but do not develop into embryos.

Sections show that the female pronucleus persists in the egg in the salt solution from two to four hours. After that time the nuclear wall disappears and the chromosomes are set free in the cytoplasm, usually in the form of a dense cluster. During the time that the eggs are in the salt solution the artificial astrospheres that have been described for fertilized eggs appear. When the eggs were returned to ordinary sea water the chromosomes separate and probably divide. The rays of the artificial astrospheres that come in contact with the chromosomes thicken and become less granular. The chromosomes now begin to migrate towards the centers of the surrounding astrospheres. Later the chromosomes form resting nuclei, two or more. Around these nuclei as centers the protoplasm begins to constrict, forming the cleavage spheres seen from the surface. Half an hour later the nuclei again resolve themselves into chromosomes and a new division, etc., succeed.

The artificial astrospheres slowly fade

* The Living Substance: As Such and as Organism. G. F. Andrews. Ginn & Co. 1897.

out and take no further part in subsequent divisions. The spindles that form after this time are very small and resemble the central spindle described by R. Hertwig for other echinoderm-eggs. The experiment shows that the additional sodium chloride added to the sea water acts as a stimulus on the nucleus, starting in it a series of changes leading to a division and separation of the chromosomes. The effect lasts through a long series of subsequent divisions. The artificial asters, as long as present, seem to act as centers towards which the chromosomes move. The rays of the astrospheres that come in contact with the chromosomes change their structure in very much the same way as do the rays that form the spindle in the ordinary karyokinetic figure.

Centrosome and Sphere in the Fertilized Egg of Unio. F. R. LILLIE.

STARTING with the typical structure of the aster in the metaphase of either maturation spindle, viz.: A small centrosome with the radiations inserted in it, and surrounded by inner and outer strata of microsomes forming inner and outer spheres, it was shown that by fusion of the stratum of microsomes bounding the inner sphere and by peripheral accumulation of its ground substance, the inner sphere is converted into a vesicle during the anaphase and telephase of both maturation divisions. This vesicle is now the central area of attachment of the radiations; and the centrosome proper is attached to the wall of the sphere by fibers, which are not part of the general system of radiations.

It was shown further that the central spindle of the second maturation division is formed within the inner sphere, and that during the prophase the centrosomes increase greatly in size and fragment into a number of *centrosome granules*, one of which remains as the centrosomes of the later

stages (mother-star and later), while the others form in part the stratum of microsomes bounding the inner sphere, and in part become resolved into the ground substance of the inner sphere.

Combining these results with those announced before the Society in the winter of 1896 (SCIENCE, V., 114, March 5, 1897), the study of the maturation and fertilization of the egg of *Unio* was stated to offer the following evidence against the theory of the permanence and uniqueness of the centrosome:

1. A sperm amphiaster is formed, but it disappears utterly at the time of the metaphase of the first maturation spindle.
2. Entirely independently of the sperm and egg asters, there arises in the egg of *Unio* at the time of the metaphase of the second maturation spindle an accessory aster, in the center of which is a minute centrosome. This centrosome divides and a small amphiaster is formed, which entirely disappears at the beginning of the telephase.
3. After the formation of the second polar globule the egg centrosome goes the way of its kind (i. e., disappears).
4. The two cleavage centrosomes arise independently of any of their predecessors, and apparently separately.
5. Fission products of the centrosomes become cytomicrosomes.

Thus the egg of *Unio* furnishes evidence, in the first place, that the centrosomes are not genetically continuous; in the second place, that a centrosome may arise *de novo* (accessory aster); and, in the third place, that products of division of the centrosome may become other formed elements of the cell.

A somewhat fuller statement is to appear in the *Zoological Bulletin*

The Fertilization of the Egg of Molgula Manhattanensis. H. E. CRAMPTON, JR.

Upon deposition, a series of changes is inaugurated leading to the formation, entirely from the germinal vesicle, of a barrel-shaped maturation spindle. *This spindle is devoid, as far as can be ascertained, of centrosomes, asters, centrospheres, etc., at both ends.* The spindle moves as a whole to the periphery, the sixteen chromosomes divide, the daughter chromosomes diverge to the head of the barrel, and the first polar body is extruded. The spindle fibers withdraw from the chromosomes and condense at the middle of the extent, forming a dense Zwischenkörper. A second maturation spindle is formed, a counterpart of the first, except that eight chromosomes pass into the second polar body, while eight remain in the egg. A vesicular nucleus is formed by these latter. The polar bodies arise at the area destined to be the vegetative pole.

The sperm enters at or near the future animal pole. The sperm-head is preceded by a double centrosome, surrounded by a distinct aster. The centrosomes diverge, as they progress inwards, each surrounded by an aster, but without any fibers passing between them comparable to the 'central spindle' of the annelid, mollusk and other types. After the asters have taken up their positions for the future cleavage-figure the now vesicular sperm-nucleus and the egg-nucleus take up their positions side by side midway between the asters.

A *barrel-shaped spindle*, precisely similar to that of the maturation stages, is formed *entirely from the segmentation nucleus.* The presence of an aster and a double centrosome at either end of the figure gives the appearance of a continuous spindle passing from center to center. Such, however, is not the case. After division of the chromosomes the daughter products diverge only to the heads of the barrel, not one-half the distance to the centrosome. There they become vesicular and ultimately fuse, while the spindle-fibers

withdraw from them to form a 'Zwischenkörper,' as in the maturation stages. Only then does the cell divide. And only after the formation of the vesicular daughter-nucleus do the two centrosomes in each cell move apart. When they do, the daughter-nucleus moves up between them, and the series is repeated. A comparative independence, then, of the processes undergone by the nucleus on the one hand, and the centrosomes and asters on the other, is indicated.

The Asters in Fertilization and Cleavage. E. G. CONKLIN.

In *Crepidula* and several other genera of marine gasteropods there is a well-marked centrosome and sphere in both polar spindles. In the metaphase this centrosome is a single densely-staining body; in the anaphase it greatly enlarges, and the center of the body does not stain; in the telephase it becomes a large sphere with an extremely thin surface layer, containing a large number of coarse granules. During the metamorphosis the centrosome has changed its staining reactions; in the prophase and metaphase it takes only nuclear stains; in the telephase it takes only plasma stains, while in the anaphase it takes both.

Though the spermatozoon frequently enters before the first polar body is formed no sperm aster appears until the metaphase of the second polar spindle. This aster is large and conspicuous, though not as large as the aster of the second polar spindle which remains in the egg; it frequently contains several dark-staining granules. At the same time one or more accessory asters appear in the egg; these are much smaller than either the egg or sperm aster, and no centrosome could be found in them. The sperm and egg asters become very large and have the same structure and staining reactions, the radiations from them proceeding for some distance through

the egg. Each remains in close contact with its own nucleus, so that there is no possibility of confusing and mistaking them. When the pronuclei come together the asters also come into contact. The origin of the cleavage centrosomes has not yet been satisfactorily determined.

In the prophase of the first cleavage the chromatin is clearly distinguishable into two kinds, oxychromatin and basichromatin; the latter only takes part in forming the chromosomes; the former becomes arranged like beads on the spindle fibers and is apparently drawn to the two poles. It seems to take no part in the formation of the daughter nuclei and probably forms a part of the granular substance of the sphere. All the cleavage centrosomes undergo a metamorphosis similar to that of the polar spindles and in the telephase of each cleavage the poles of the spindle are occupied by a granular sphere frequently as large as the nucleus, or even larger. These spheres, in every case, move to those portions of the cells which lie nearest the polar bodies. In this position they can be recognized through one and, in some cases, two or three subsequent divisions. It results from the fact that after the first two cleavages the sphere substance is differently distributed to the different cells, the entire sphere substance of one generation always going into those cells of the next generation which lie nearest the animal pole. This differential distribution of the spheres has been followed through every cleavage up to the 24-cell stage. As the form of cleavage is perfectly constant it follows that the sphere substance of any generation goes into certain definite cells which have a perfectly constant origin and destiny. This differential distribution of the spheres is not caused by their specific weight, since their movements are the same in whatever position the egg may be placed. It seems to be

the result of a form of polarity which, like that of the egg itself, is not the result of gravity.

The centrosomes do not apparently arise from the sphere substance of the previous division, but some distance from it, and the sphere substance itself never divides, but each sphere ultimately grows ragged at its periphery and gradually fades out into the general cytoplasm.

The differential distribution of these spheres and their subsequent conversion into cytoplasm suggests that they may be important factors in the differentiation of the cleavage cells, and if further investigation should establish the fact that they are in part composed of the oxychromatin of the nucleus it would furnish a basis, in fact, for certain well known speculations of DeVries, Weismann and Roux.

Considerations on Cell-lineage and Ancestral Reminiscence, based on a Re-examination of Some Points in the Early Development of Annelids and Polyclades. EDMUND B. WILSON.

THIS paper attempted to reconcile the apparent contradiction in cell-lineage between the annelids and polyclades, and to show that homology and ancestral reminiscence may appear as clearly in the cleavage period as in other stages. In *Leptoplana*, a polyclade, all of the first quartets of micromeres produce ectoblast, as in the annelids or mollusks, while the main mass, if not all, of the mesoblast arises by delamination from the second quartet. The formation of ecto-mesoblast ('larval mesenchyme,' or 'secondary mesoblast') from cells of the second or third quartets in the mollusks was interpreted as a reminiscence of what occurs in the polyclade, and evidence was given that a similar reminiscence occurs in some annelids (*Aricia*).

In the polyclade the fourth quartet is purely entoblastic; but the posterior cell

divides symmetrically, always (*Discoælis?*), or occasionally (*Leptoplana*). This cell is probably to be regarded as the prototype of the second somatoblast of annelids and mollusks, which divides symmetrically to form the 'primary mesoblasts,' the mesoblast bands (ento-mesoblast) being a new formation and the ecto-mesoblast ('larval mesenchyme,' etc.) being homologous with the mesoblast of the polyclades. This interpretation is sustained by the fact that the posterior cell of the fourth quartet may contain entoblastic elements largely developed (*Crepidula*), considerably reduced (*Nereis*) or reduced to a pair of rudimentary or vestigial cells (*Aricia*, *Spio*). The latter strikingly illustrate ancestral reminiscence in cell-lineage, and represent the penultimate stage in a series which begins with the polyclade. These facts and others were urged in support of the cell theory of development and the value of cell-lineage in the investigation of homologies.

The Characters and Phylogeny of the Amblypoda. H. F. OSBORN.

As a result of the recent explorations by the American Museum of Natural History, a complete skeleton of *Coryphodon* has been procured and mounted, as well as a nearly complete skeleton of *Pantolambda*, not only one of the oldest geological, but the most archaic type of ungulate, from a morphological standpoint, hitherto discovered. The restoration of this animal shows it was completely plantigrade, progressing upon the plantar and palmar surfaces of the feet, like a bear. There is an os-centrale carpi as in the *Creodonta*, and the whole skeleton, is strongly impressed with the Creodont type, reinforcing the evidence already derived from the Phenacodontidæ, that the Ungulata sprang from Unguiculate animals. This restoration agrees with a prior restoration of *Periptychus*, and the resemblances between these two skeletons are very

marked, supporting the author's views expressed in 1893, that *Periptychus* should be placed among the Amblypoda. This gives this very ancient order of ungulates a very wide functional variation from small arboreal types to the huge *Uintatheres* of the Eocene. The evolution of the skull can now be fully traced out, and in *Coryphodon* we observe the rudiments of the frontal and parietal horns of *Uintatherium*.

A Series of Specimens Illustrating the Development of the Chick. MRS. S. P. GAGE.

THESE illustrate Professor Gage's idea that in an embryological series for a museum all stages sufficiently different to be easily recognized by the naked eye are to be included, to the adult condition. They are the unincubated germ, the 12, 18, 24, 36, 48, 60, 72 and 96-hour chick; and from this point on to hatching are at intervals of one day, ending with a chick just emerging from the shell at the 21st day. Mounted skins of chicks 24 hours and six days after hatching, of one in the stage known commercially as a broiler and of a hen and rooster complete the series.

All the specimens were fixed in 10 per cent. nitric acid, washed to free from yolk and preserved in alcohol. From the 7th day on, the membranes were too extensive to show both them and the chick, and parallel series were arranged in the same jar, one to exhibit the chick and one the membranes.

The earlier stages were mounted on cover glasses, which had been albumenized and built up in a slightly convex form with collodion and brushed with a coating of collodion containing lamp black. The germ was floated on to the cover under alcohol and fixed in place by thin collodion. Glass strips to fit the jars were prepared by albumenizing and (unless the glass were black) coating with thin collodion containing lamp black, thus giving a strongly con-

trasting background. The cover glasses were mounted on the glass strips and held in position by collodion.

For the older stages, where the membranes stretch far around the yolk, thick (6 per cent.) collodion was moulded in Reighard's watch glasses, hardened in chloroform and coated with black collodion. The membranes were then floated over the mass, fixed in position with thin collodion, and these mounted specimens without membranes were fastened in position on the glass slides with collodion.

A separate series was made to show the change of form of the brain in course of development.

On the Amblyopsidae. C. H. EIGENMANN.

THE members of the Amblyopsidae and their distribution are as follows: *Chologaster cornutus*, abundant in the lowland swamps of Virginia and Georgia; *Chologaster Agassizii*, subterranean streams of Tennessee and Kentucky; *Chologaster papilliferus*, springs of Union and Jackson counties, Ill.; *Amblyopsis spelæus*, subterranean streams of the Ohio Valley; *Typhlichthys subterraneus*, subterranean streams of the Ohio Valley, chiefly south of the Ohio River; *Typhlichthys roseæ*, subterranean streams west of the Mississippi.

The eyes of all the species except those of *Ch. Agassizii* have been examined. In *Chologaster* the eyes are normally placed and functional. *Ch. papilliferus* possesses the better eyes, but even here many signs of degeneration are apparent, the inner layers of the retina being less in thickness than the pigmented layer. In *Ch. cornutus* the pigmented layer forms two-thirds of the thickness of the retina, the nuclear layers are each composed of a single series of nuclei and the ganglionic layer of cells widely separated from each other. The lens and vitreal body are normal. In all the species examined the eyes have sunk be-

neath the surface, the lens and vitreal body have practically disappeared; the eye has, as a consequence, collapsed and is minute. Part of the ganglionic layer forms a central core of cells in *Amblyopsis* and *T. subterraneus*. In the former the pigmented layer is highly developed; in the latter, while still present, it is entirely without pigment. In *T. roseæ* the eye has degenerated further than in the eastern species. The central core of ganglionic cells has disappeared; the pigmented layer is imperfect; the inner reticular layer occupies a central, or rather posterior, position around which the nuclear layers are placed. Lens and iris are gone, and the entire eye is but 40-50 μ in diameter.

Conclusions: The three species of blind fish are of independent origin. The results of degeneration are not the same on the homologous structure of the eye in the three species. The degeneration is not the result of arrested development or of ontogenic degeneration. The eye of the Amblyopsidae, reaching its greatest point of degeneration in *T. roseæ*, is the result of phyletic degeneration begun before the fish entered the caves. Their degenerate eyes are not primarily due to their habitat in caves, i. e., to the absence of light; rather are they found in the caves because they were largely able to do without the use of their eyes, and therefore succeeded in establishing themselves in the caves. In this they were aided by their peculiar method of raising their young in their gill cavities.

The two Common New England Salamanders, Desmognathus and Spelerpes, and their Importance as Laboratory Animals. H. H. WILDER. (Read by title only.)

Accessory Optic Vesicles in the Chick Embryo. W. A. LOCY.

It was shown that in chick embryos two distinct sets of vesicles make their appear-

ance in the neural tube: A transitory set that arise in connection with the original optic differentiation, and which completely disappear before the second set or true brain vesicles arise. The lateral expansions of the neural tube which constitute the beginning of the eye vesicles are elongated, and they are converted into the true optic vesicles in front and a succession of similar but smaller ones which are serially arranged behind the former. The latter series, which consists of six pairs of vesicles, is very transitory, passing through the stages of rise, culmination and decline within three or four hours' time.

The structures occur in normal embryos. Five hundred eggs were incubated and fifty embryos obtained at the right ages to show the history of these structures. They were studied in living specimens in warm salt solution. The observations were originally made in 1893 and verified and reverified in a variety of ways since that time. The specimens were sketched, photographed, sectioned and, in some cases, reconstructed. By placing the specimens under a dissecting microscope, where several can be viewed at the same time, and making a critical comparative study of all the embryos, they may be arranged in a graded series, the extremes of which differ considerably, but the intermediate embryos show slight gradations. In such a series it is observed that these vesicles do not, in any case, develop progressively to become brain vesicles, but undergo decline before the brain vesicles appear. At their period of greatest development—between the 24th and 26th hour, with six somites—there are six pairs; they are reduced during the next hour to four pairs, and, at about the 27th hour, with eight somites, they are reduced to two, which rapidly fade away. From this period the true brain vesicles begin to appear. The author's observations on the development of the brain vesicles agree

with those of Duval, Platt and other observers. It was shown that the first set of vesicles are independent of the brain vesicles and have not before been figured.

The theoretical bearing of the facts is obvious, and, although the author designates these structures 'accessory optic vesicles,' from their connection with the original optic differentiation and from their resemblance to the primary optic vesicles, nevertheless he holds this view in the lightest way, ready to withdraw it whenever any better interpretation may be presented. The validity of the facts is held to be established, and their history has been carefully worked out. Demonstrations of these structures to those interested followed.

The Thoracic Derivatives of the Post-cardinal Veins in Swine. G. H. PARKER.

EMBRYONIC pigs of about six millimeters greatest length possess well developed right and left post-cardinals (posterior cardinal veins) which extend from the base of the corresponding posterior extremities anteriorly over the dorsal surfaces of the Wolffian bodies to the region of the heart. The thoracic portion of each post-cardinal persists from the region of the heart to the tenth pair of ribs, beyond which a new vessel, the accessory vein, is developed, reaching to a point some distance posterior to the last pair of ribs. The combination of the post-cardinal and accessory vein of the right side gives rise to the azygos vein; the corresponding veins of the left side produce the hemiazygos. The azygos and hemiazygos veins receive the intercostal veins of their respective sides, and become mutually connected by several transverse veins. In later embryonic life the cardinal portion of the azygos vein usually degenerates completely, and the right intercostal veins connected with this part find outlets through the corresponding part of the hemiazygos which persists in the adult pig. The

accessory parts of the azygos and hemiazygos veins may remain connected with the cardinal part of the hemiazygos and by their variations give rise to three structural types: First, one in which both accessory parts are equally developed; secondly, one in which the hemiazygos accessory part predominates; and thirdly, one in which the azygos accessory part predominates.

The Veins of the Wolfian Body. C. S. MINOT.

DR. MINOT had studied especially the condition in pig-embryos of 12.0 mm. The cardinal vein ends abruptly at the cephalic end of the Wolfian body; the vena cava inferior is also well developed and communicates widely with the middle of each mesonephros. Between the Wolfian tubules there are no capillaries, but only large sinuses, the endothelium of which lies close against the epithelium of the tubules. The sinuses communicate freely with both the cardinal and cava veins. Along the dorsal side of the Wolfian body there is no continuous cardinal vein, but there are still two channels of reduced size, representing the lower parts of the cardinal which have become united with the cava inferior.

New Embryological Observations. C. S. MINOT.

THE author described: (1) the mesothelial villi of the allantois in the pig; (2) the development of the hypophysis and infundibular gland in the pig, *Amia*, *Batrachus*, *Ameiurus* and *Necturus*, confirming and extending the results of Béla Haller; (3) observations upon various vertebrate types, tending to show that the zones of His have a constant morphological value; (4) the fore-brain of *Ameiurus Embryos*, clearly similar to that of other types of vertebrates as concerns the hemispheres and foramen of Monro; if this observation is confirmed by further study it will show that neither the theory of Burkhhardt nor that of Studniska in regard to homologies of the Teleostean fore-brain is correct.

A Peculiar Glandular Structure found in a Mexican Diplopod. F. C. KENYON. (Read by title only.)

THE structure was found in the repugnatorial glands of specimens of the diplopod genus *Platydesmus* from Mexico. It arises from the proximal inner surface of the walls of the bottle-shaped repugnatorial gland and projects into the glandular cavity, presenting in section very much the appearance of a section of an ordinary mushroom and its stalk. Its base and the distal, or expanded cap-like portion, are well provided with medium-sized, somewhat oval nuclei. The stalk exhibits a striated appearance. In the expanded cap only fragments of cell boundaries have been distinguished.

In some respects the organ resembles the structure that has been figured for the phosphorescent organs of some deep-sea animals, but *Platydesmus* is not known to have the power of emitting phosphorescent light, and only one diplopod has ever been described as having such a power. In this one form, *Fontaria luminosa* Ken., the light was described by the person who observed it as arising from spots corresponding in position to the repugnatorial glands. A light-emitting function is suggested for the peculiar structure noted. Whether the suggestion will eventually prove to be a fact, however, is a question which the collector must be largely depended upon to decide.

The following officers were elected for the ensuing year: President, Henry F. Osborn, Columbia; Vice-President, T. H. Morgan, Bryn Mawr; Secretary-Treasurer, G. H. Parker, Harvard; Members of the Executive Committee from the Society at large, C. B. Davenport, Harvard, and F. R. Lillie, Michigan.

G. H. PARKER,
Secretary.

HARVARD UNIVERSITY.

A. JOLY.

THE recent death of Professor A. Joly, director of the chemical laboratory of the École Normale Supérieure and professor in the Paris Faculty of Sciences, deserves more than passing mention. His early work was as an assistant in the laboratory of Sainte-Claire Deville, and later he became sub-director of the École Normale laboratory under Debray, whom he succeeded. His first published work (1875-7) was on columbium and tantalum, in which he added much to our knowledge of these rare elements, formed synthetically several of the rare columbium minerals, and proved the non-existence of Marignac's *ilmenium*. His next work (1882-7) was on the general and thermal chemistry of the acids of phosphorus and arsenic, among the points touched upon being the relations of these acids and baric acid to indicators. No less than twenty-four papers, mostly published in the *Comptes Rendus*, belong to this period. It was at this time, too, that he made a study of the carbide of boron, as he had earlier that of columbium, and carried this work as far as was possible till the introduction of Moissan's electrical furnace.

Joly's most important work dates from 1888, when he entered upon the study of the rarer elements of the platinum group, beginning, in conjunction with Debray, upon the oxides of ruthenium. Potassium ruthenate and perruthenate were for the first time obtained in a pure and crystallized condition; the supposed tetrachloride of ruthenium of Claus, having an analogous formula to that of the chlorides of the other platinum metals, was shown to be not RuCl_4 , but RuCl_4NO , a nitroso-chloride, in which the NO group acts in the place of a halogen atom; several new series of ruthenium ammonium bases were formed, among them one derived from the nitroso-chloride—

'ruthenium red'—which possesses wonderful tinctorial powers, closely resembling an organic dyestuff. It has been used in histology and bacteriology, and is said to be the 'only reagent for the products of transformation of pectic compounds.'

In other papers the constitution of osmic acid of Fritzsche and Strure was at last cleared up, it proving to be a nitroso compound; the double nitrites of the platinum metals were studied, and their action when decomposed by heat; and a new method was devised for separating the platinum metals. Atomic weight determinations of ruthenium, iridium and palladium were made, the first being particularly valuable, as there had been no work on this since that of Claus, and Joly's determination brought ruthenium into its proper place in the periodic table. By means of the electric furnace Joly was enabled for the first time to obtain ruthenium and osmium in a coherent state and to study the properties of the fused metals.

Altogether in his less than a quarter of a century of work Joly published about sixty papers, a number of the later ones in conjunction with Vèzes and Leidié. He was the author of numerous articles in the *Encyclopédie Chimique* (Dunod), and the author of a number of text-books, which have been through several editions: *Éléments de chimie*; *Cours élémentaire de chimie et de manipulations chimiques*, 3 vols; and *Cours élémentaire de chimie* (notation atomique), 3 vols. Professor Joly was one of the relatively few chemists whose lives have been devoted to inorganic chemistry, and who, working over and clearing up old fields once passed over but yet little explored, rather than penetrating into wholly unknown regions, has thereby served to put chemistry on a firmer basis. Dead at only fifty-one years of age, he can be ill spared.

JAS. LEWIS HOWE.

THE FIRST AWARD OF THE LOBACHÉVSKI PRIZE.

THE Lobachévski prize is adjudged every three years. Its value is five hundred roubles. It is given for work in geometry, preferably non-Euclidean geometry. All works published within the six years preceding the award of the prize, and sent by their authors to the Physico-Mathematical Society of Kazan, are allowed to compete if published in Russian, French, German, English, Italian or Latin.

The Society has now in formal session awarded the prize to Sophus Lie, professor of mathematics at the University of Leipzig, for his work 'Theorie der Transformationsgruppen, Band III., Leipzig, 1893.' In this work the theory of non-Euclidean geometry has been exhaustively re-stated and re-established in a profound investigation of the work of Helmholtz on the space-problem.

To the genius of Helmholtz is due the conception of studying the essential characteristics of a space by a consideration of the movements possible therein.

But since the time when Helmholtz did his work on this subject the greatest of living mathematicians, Sophus Lie, formerly of Christiania, has enriched mathematics with a new instrument, the Theory of Groups, which its creator has applied with tremendous power to the Helmholtz treatment. Lie finds, as was almost inevitable, that certain details had escaped the great physicist, but that, with the tact of true genius, he had kept his main results free from error, though there comes to light a superfluity in his explicit assumptions, an unconscious assumption now seen to be mathematically important for the rigor of the demonstration, and at least one definite error in minor results.

Lie's method is in general the following. Consider a tri-dimensional space, in which a point is defined by three quantities, x, y, z .

A movement is defined by three equations:

$$x' = f(x, y, z); y' = \varphi(x, y, z); z' = \psi(x, y, z).$$

By this transformation an assemblage, A, of points (x, y, z) becomes an assemblage, A', of points (x', y', z') .

This represents a movement which changes A to A'.

Now make, in regard to the space to be studied, the following assumptions:

1st. Assume: In reference to any pair of points which are moved, there is *something* which is left unchanged by the motion.

That is, after an assemblage of points, A, has been turned by a single motion into an assemblage of points, A', there is a certain function, F, of the coordinates of any pair of the old points $(x_1, y_1, z_1), (x_2, y_2, z_2)$ which equals that same function, F, of the corresponding new coordinates $(x'_1, y'_1, z'_1), (x'_2, y'_2, z'_2)$; that is, $F(x_1, y_1, z_1, x_2, y_2, z_2) = F(x'_1, y'_1, z'_1, x'_2, y'_2, z'_2)$.

This *something* corresponds to the Cayley definition of the distance of two points when interpreted as completely independent of ordinary measurement by superposition of an unchanging sect as unit for length.

This independence, involving the determination of cross-ratio without any use of ordinary ratio, without using congruence, without using motion, Cayley never clearly saw. It follows from the profound pure projective geometry of von Staudt.

2d. Assume: If one point of an assemblage is fixed, every other point of this assemblage, *without any exception*, describes a surface (a two-dimensional aggregate).

When two points are fixed a point in general (exceptions being possible) describes a curve (a one-dimensional aggregate). Finally, if three arbitrary points are fixed, all are fixed (exceptions being possible). With these assumptions Lie proves exhaustively that the general results

of Helmholtz and Riemann follow ; that is, there are three, and only three, spaces which fulfill these requirements, namely, the traditional, or Euclidean space, and the spaces in which the group of movements possible is the projective group transforming into itself one or the other of the surfaces of the second degree

$$x^2 + y^2 + z^2 \pm 1 = 0.$$

In the appreciation of this work of Lie's, prepared for the Society by Felix Klein, for which the Lobachévski gold medal was given him, he says that Lie's work stands out so prominently over all the others to be compared with it that a doubt as to the award of the prize would scarcely have been possible. Decisive for this judgment as to the height of the scientific achievement is not only the extraordinary depth and keenness with which Lie, in the fifth section of his book, handles what he has called the Riemann-Helmholtz space problem, but especially the circumstance that this treatment appears, so to say, as logical consequence of Lie's long-continued creative work in the province of geometry, especially his theory of continuous transformation groups.

The extraordinary importance which the works of Lie possess for the general development of geometry can scarcely be overestimated. In the coming years they will be still more widely prized than hitherto. Passing, then, to the consideration of the present state of the space question, Klein takes up the origin of axioms. Whence come the axioms? A mathematician who knows the non-Euclidean theories would scarcely maintain the position of earlier times that the axioms as to their concrete content are necessities of the inner intuition.

What to the uninitiated appears as such necessity shows itself, after long occupation with the non-Euclidean problems, as the

result of very complex processes, and especially education and habit.

Do the axioms come from experience? Helmholtz energetically says yes! as is well known. But his expositions seem in a definite direction incomplete.

One will, in thinking over these, willingly admit that experience plays an important part in the formation of axioms, but will notice that just the point especially interesting to the mathematician remains untouched by Helmholtz.

It is a question of a process which we always complete in exactly the same way in the theoretical handling of any empirical data, and which, therefore, may seem quite clear to the scientist.

Expressed generally: *Always the results of any observations hold good only within definite limits of precision and under particular conditions; when we set up the axioms we put in the place of these results statements of absolute precision and generality.*

In this 'idealizing' of empirical data lies, in my opinion, the peculiar essence of axioms. Therein our addition is limited in its arbitrariness at first only by this, that it must cling to the results of experience and, on the other hand, introduce no logical contradiction.

Then enters as regulator also that which Mach calls the 'economy of thinking.' No one will rationally hold fast to a more complicated system of axioms when he sees that with a simpler system he already completely attains the exactitude requisite to the representation of the empirical data.

Klein goes on to mention the possibility of a series of topologically distinguishable space-forms built of limited (simply compend) space-pieces either all Euclidean, all Lobachévskian or all Riemannian. Beside these three just mentioned family-types, the parabolic, the hyperbolic, the single elliptic, Klein has shown that the spherical, in which two geodetics always

ent in two points, is the only one which as a whole is freely movable in itself.

Then Klein says: "I consider all the topologically distinguished space-forms as equally compatible with experience. That in our theoretic considerations we prefer some of these space-forms (namely, the family types, that is, the properly parabolic, hyperbolic, elliptic) in order to finally assume the parabolic geometry, that is, the customary Euclidean geometry, as valid, happens simply from the principle of economy."

GEORGE BRUCE HALSTED.

AUSTIN, TEXAS.

EARTHQUAKE SHOCKS IN GILES CO., VA.*

IMMEDIATELY following the earthquake of May 31, 1897, which was distinctly felt over most of the eastern portion of the United States, came newspaper reports of continued disturbance in the form of explosions and earth tremors in Giles county, Virginia. It was also reported that Mountain Lake had been drained, that the wells of Saltville, Virginia, had ceased to flow, and that large fissures had opened in the earth at various points in Giles county. At the urgent request of several citizens of Pearisburg, and with the idea that possibly there might be some foundation for the rumors afloat, I visited the region in the early part of June. The reports were found to be grossly exaggerated, as no disturbance had occurred at Mountain Lake, the Saltville wells were flowing as usual, and no fissures had appeared within the limits of Giles county. Under the circumstances the scientific results of my visit were insignificant, but there were certain phenomena observed which seemed to be worth recording.

The county of Giles lies on the north-western side of the Appalachian Valley. Its surface is diversified by numerous ridges

which cross the country from northeast to southwest. The rocks have been thrown into great folds, and are broken by numerous faults which also cross the region in the same direction. The principal object of my visit was to determine, if possible, whether there was any relation between the present disturbance and the geologic structure of the region; but, from the nature of the case, only a little information was obtained on the subject.

The earliest generally recognized earth tremor occurred on May 3. It loosened some bricks from old chimneys and was accompanied by considerable noise, like low rumbling thunder. From May 3 to 31 no shock of importance occurred, but many noises were heard, similar to the rumbling that accompanied the first quake. Many persons now believe that the same sort of noises occurred for a long time prior to May 3, but were passed unnoticed by the people, who, at that time, did not have their nerves wrought to such a tension that they heard and felt the slightest shock or earth tremor.

The shock of May 31 was probably more severe in and about Pearisburg than at any other point from which I have information. No serious damage was done even here, but old brick houses were badly shaken, and many chimneys were cracked and the top-most bricks hurled to the ground. Much noise accompanied this shock, and many of the inhabitants, already much disturbed by the previous heavy shock and the continued rumblings beneath them during the month, were terror-stricken. The noise did not stop with the main shock, but tremors and rumblings, or sharp reports, are described as occurring during the entire night following the shock. The intensity of these rumblings or reports varied according to location. Those of greatest severity were reported from the angle between Sugar Run and Pearis Mountains. Old veterans of the

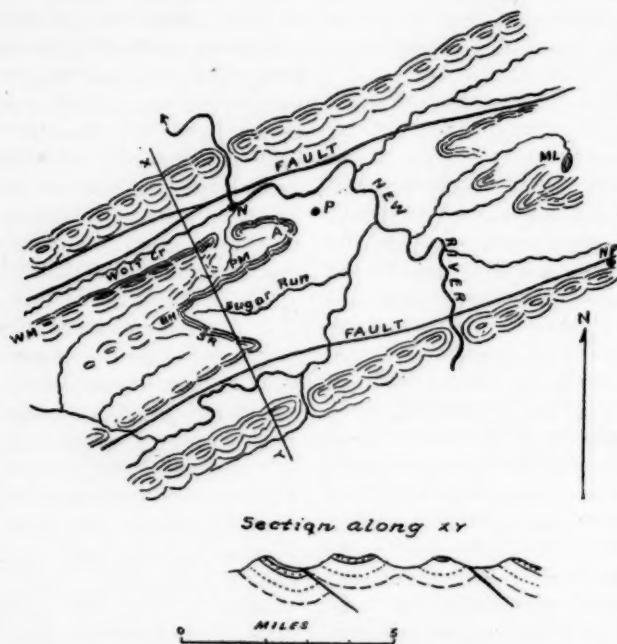
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war likened them to the reports of heavy siege guns fired at frequent intervals during the night.

From May 31 to the time of my visit, on June 6, the explosions are reported to have continued with considerable regularity, from five to ten slight shocks being about the daily average. During my stay of three days at Pearisburg I heard and felt a num-

in intensity and in frequency, until at the present time they are scarcely noticeable. Mr. Shuler estimates that there have been at least 250 distinct shocks observed at Pearisburg since the 3d of May.

The many conflicting reports of the inhabitants regarding the shocks made it almost impossible to arrive at any definite conclusion regarding the relation of the



SKETCH MAP OF THE PEARISBURG REGION.

P—Pearisburg.....	WM Wolf Creek Mt.	A—Angels' Rest.....	SR Sugar Run Mt.
N—Narrows.....	PM Pearis Mt.	NP—Newport.	
	ML—Mountain Lake...	BH Big Horse Gap.	

ber of these explosions and tremors. Ordinarily I should not have noticed most of them, merely supposing them to be distant thunder. But a few were severe enough to jar the windows perceptibly. Since then, according to the reports of Mr. J. A. H. Shuler, the Baptist minister of the town, the shocks have been growing less and less

disturbance to the geologic structure of the region, but a few facts were noted which seem to have a bearing on this interesting question.

Apparently the general shock of May 31st was most severely felt at the Narrows, which is located on one of the most complex and extensive faults of the region.

At this point the surface is said to have rolled like the groundswells of the ocean, springs were muddled and in some cases ceased to flow for a short time after the shock occurred, and a landslide of considerable proportions and a big rock rolled down off the face of Wolf Creek Mountain. The latter is no indication of great intensity, for the slopes of the mountain are so steep that a slide is liable to start at any time, and the blocks of sandstone have frequently such a precarious foothold that they will start with the slightest disturbance.

In the valley of Wolf Creek the testimony regarding the direction from which the explosions came is conflicting. Some thought that they came from immediately beneath, and some were equally certain that they came from the south—from the base of Wolf Creek Mountain. At Pearisburg there is a general agreement that the sounds and shocks always came from the west, or from the base of Angels' Rest. The shocks which I experienced at Pearisburg seemed to come from a little north of west, or from the direction of the Narrows, and they also appeared to come horizontally. In the Sugar Run region the general verdict was that they came from the north—from under Pearis Mountain, or from the west—from Big Horse Gap. In the vicinity of Pearisburg and Sugar Run the springs were disturbed, but not to the same extent as in the valley of Wolf Creek.

Pearis and Wolf Creek Mountains represent the two sides of a syncline whose point is formed by Angels' Rest. The strata of this basin are only slightly flexed, and it seems strange that it should be the seat of earth tremors. But when it is considered that the great fault along Wolf Creek valley dips toward the south at about 30 degrees it will be seen that the syncline is comparatively shallow and overlies the plane of the fault. Therefore, it seems probable that, instead of originating in the

mountain proper, the disturbance came from movement along the fault plane underneath the mountain.

Movement along this fault plane is the only hypothesis I could formulate to account for the phenomena, but if such movement occurred it must have been so slight as to be unrecognizable at the surface. The reason for the pronounced disturbance in and about Pearisburg is presumably the cavernous condition of the limestone in that region, apparently causing it to act as a sounding board, magnifying the sounds and vibrations. Newport is also reported to have suffered considerably from the shocks; this can be accounted for by the hypothesis of movement on the fault, on which it also is located.

M. R. CAMPBELL.

WASHINGTON, D.C., December 18, 1897.

BOTANICAL NOTES.

DISTRIBUTION OF GOVERNMENT BOTANICAL PUBLICATIONS.

It may not be generally known that there are many valuable publications from the several botanical divisions of the Department of Agriculture which may be obtained gratis or by the payment of a merely nominal sum. The Superintendent of Documents has issued a handy list of the publications now in his hands, with prices affixed. It will well repay every botanist not regularly receiving these publications to look over this list and secure valuable books and papers for but a slight cost.

A similar list has been issued by the Librarian of the Geological Survey of Canada (Ottawa), which contains the titles of many pamphlets and maps of much botanical value. The prices here again are very reasonable.

BAILEY'S LESSONS WITH PLANTS.

PROFESSOR BAILEY has again earned the gratitude of the public by bringing out a

new book upon plants. It need not be said to those who have read his books that this is not like other books on plants. It is new in matter, in illustrations and in method. We cannot make out whether or not it is to be used as a text-book. It is too full of suggestions for the humdrum of the ordinary class-room use. Perhaps its greatest value will be in affording stimulating suggestions to both teacher and pupil in primary and secondary schools.

The titles of the chapters are not so different from those in the familiar text-books of a generation ago. Thus we have 'Studies of Twigs and Buds,' 'Studies of Leaves and Foliage,' 'Studies of Flowers,' etc., but when we look at the treatment we find a newness and freshness which tell of the master who wrote the suggestive pages. The illustrator (Professor Holdsworth) and the publishers (The Macmillan Company) have done their share to give the book an attractive appearance.

CHARLES E. BESSEY.

CURRENT NOTES ON ANTHROPOLOGY.

ETHNOLOGIC MATERIAL FROM INDIA.

THE distinguished ethnologist Professor Bastian, after celebrating his seventieth birthday with eclat in Berlin two years ago, took a fresh start in his studies by going to India and adjacent regions, where he has been ever since, collecting most industriously all sorts of valuable knowledge. Many of his observations he has given out in a plain form in two volumes called 'Lose Blätter aus Indien,' published at Batavia. These are new contributions to the psychological ethnology which he has so earnestly advocated. I may dare to translate (no easy matter) from his preface to show the meaning of these studies: "The whole intellectual wealth of mankind, up to the most transcendental speculations, can be reduced to a minimal quantity of elementary

thoughts, each potentially pregnant with magical powers, unfolding into the most varied national mental products, and satisfying the physical longings in every direction, under the correlation of cosmical harmonies, with which the processes of thought themselves are in necessary union."

In this spirit Professor Bastian takes up the mythology and philosophy of the far East, its ethics, its legends and its religious rites, throwing new light on what is old, and adding much that is novel and striking. To the reader who likes hard reading and deep thinking, the work may be commended as sure to satisfy.

ANCIENT VARIETIES OF DOGS.

THE first domesticated mammal seems to have been the dog. In the Swiss Society of Natural History, last year, Professor Studer read a paper on ancient European dogs. The oldest variety was the so-called peat dog. It belongs to the neolithic period. There were four other varieties known in the bronze period, and in that of the lake dwellings. Direct descendants of these are the German hunting hounds, the shepherd dog and the poodle.

In America there is little evidence that any dog was trained for hunting. In the far north the Eskimo dog was a beast of draught, the only one known to the Red Race. The dogs of Mexico and Central America seem to have been principally raised for food or ceremonial sacrifices. In Peru there were several varieties under domestication, two of which have been clearly distinguished.

It is noteworthy that although in many American tribes the dog was a sacred or mythical animal in the legends, he was not regarded with affection, but with dislike and aversion, a fact strongly brought out by von Tschudi.

D. G. BRINTON.

UNIVERSITY OF PENNSYLVANIA.

NOTES ON INORGANIC CHEMISTRY.

GEORGE MÉKER, in a recent *Comptes Rendus*, calls attention to the fact that, while fused sulfate of ammonium or the alkaline halids have little or no effect on platinum, a mixture of ammonium sulfate and bromid or potassium bromid corrodes the metal very rapidly. Platinum black or even finely divided metallic platinum, is rapidly brought into combination with this mixture at 330° , the bromo-platinate of ammonium being formed. The other metals of the platinum group have not been tested with this mixture by the author.

It is many years since Dr. Künzel called attention to the fact that in a nickel solution containing potassium nitrite even traces of a calcium salt give a yellow precipitate. Several of these triple nitrites have been from time to time studied, and in the last *Zeitschrift für anorganische Chemie* Carl Przibylla gives a systematic study of these salts. $\text{CuBaK}_2(\text{NO}_2)_6$ may be taken as a type of the triple nitrites. The copper may be replaced by nickel or iron, the barium by calcium, strontium or lead, and the potassium by ammonium. The salts are very insoluble, not stable in the presence of water, and some of them appear to be mixtures, but even these mixtures closely approximate the above formula.

The work of Melikoff and Pissarjewsky on peruranic acid was recently noticed in this column. According to their view of the constitution of this acid, its ammonium salt should contain ammonium peroxid, and their efforts to obtain this compound are the subject of a preliminary communication in the last *Berichte*. By mixing concentrated ether solutions of hydrogen peroxid and ammonia at -20° , a thick liquid was obtained which had little odor of ammonia, and which, on further cooling with liquid carbon dioxid, crystallized. Analysis of the crystals gave the composition $(\text{NH}_4)_2$,

$\text{O}_2, 2\text{H}_2\text{O}_2, 10\text{H}_2\text{O}$. The water of crystallization seems not to be constant, but the existence of the peroxid of ammonium of the formula $(\text{NH}_4)_2\text{O}_2, 2\text{H}_2\text{O}_2$ appears well established.

J. L. H.

SCIENTIFIC NOTES AND NEWS.

THE TOTAL ECLIPSE OF THE SUN.*

THE observation of the total solar eclipse in India has been a magnificent success. Here at Talni, during the three weeks of our preparations, we never saw a single cloud and to-day has been as perfect as those which have preceded it, and whilst we are rejoicing over our own good fortune the news is flashed to us that at Buxar, in the east, and Jewar, in the west, observers have been equally favored. Thanks to the forethought of our host, Lieutenant Morris, no spectators were allowed to approach within several hundred yards of our camp, and we observed the superb spectacle free from the slightest interruption. The first encroachment of the dark body of the moon gave us an hour and a half's warning of totality, and slowly indeed did the first part of that time pass. A fine procession of sharply-defined spots lay across the solar disc, and were swallowed up one by one by the invading darkness. The air, which had been intensely hot, grew chill, the weird sense of approaching disaster which always accompanies an eclipse oppressed the nerves, and then, with what seemed a sudden rush, the shadow fell.

I was watching the eclipse through a binocular, one lens of which was fitted with an eyepiece prism. As totality approached the burning spectrum at the sun became crowned with dark semicircles—the Fraunhofer lines. These grew finer and sharper, and then suddenly turned to bright flame at either end of the semicircles. The continuous spectrum narrowed, the bright arch grew with startling swiftness, a long constellation of glittering points sparkled out for a fraction of a second, and totality had begun. 'Go!' I cried. The signal clock was started, and its clear beat rang out, emphasized at every tenth second by the

* A cablegram to the London Times.

sharp ting of its bell, and the warning voice of the timekeeper called, 'One hundred,' 'Ninety,' 'Eighty,' according to the number of seconds still left us.

Just behind me Captain Molesworth and Mrs. Maunder, at an equatorial with two cameras, were changing plates with the confidence and precision begotten of much practice. With each camera six plates were to be exposed, and all went without a hitch, but, just as the word came for the sixth exposure, with a sudden rush an immense flood of sunlight poured forth. The eclipse had been four seconds short of the time we had expected. Meantime Mr. Thwaites had secured three photographs and Lieutenant Morris exposed several plates in small cameras. Further east Mr. Evershed, with a threefold arrangement of spectroscopes, exposed plates to catch the spectrum of the corona, and especially of the flash. Between our other occupations we looked up at the magnificent spectacle before us. The darkness did not equal the eclipses of 1886 or 1896, but the corona stood out in the sky as a vast silver star, brighter and more extended than when I saw it eleven years before. Two fine leaf-shaped extensions stretched out almost horizontally east and west, whilst nearly, but not quite, on the sun's equator, directed southwest, was the greatest ray of all, two millions of miles in length almost, pointing to where one celestial brilliant glittered several degrees away.

I had hoped to ascertain the distribution of the element coronium in the corona, but the green line, which for us composes its spectrum, was very faint, and was not seen at all on the eastern side of the sun. On the west it was traced to about 5' in height. Whilst telegraphing we learn that Professor Naegamvalla secured forty photographs at Jewar, completing his program.

E. W. MAUNDER.

AMERICAN MATHEMATICAL SOCIETY.

A REGULAR meeting of the American Mathematical Society will be held on Saturday, February 26th, in Room 301 of the Physics Building of Columbia University, New York City. The two sessions will begin at 10:30 a. m. and 2:30 p. m., and the Council will meet at 2 p.

m. From all indications this meeting promises to rival in interest the recent very successful annual meeting of the Society. The following papers have thus far been entered for presentation:

1. PROFESSOR MAXIME BÔCHER: 'The theorems of oscillation of Sturm and Klein.'
2. DR. J. W. DAVIS: 'Behavior at laboratory temperatures of gas and vapor generating globes in celestial spaces.'
3. MR. P. R. HEYL: 'The measure of the bluntness of the regular figures in four dimensional space.'
4. DR. J. I. HUTCHINSON: 'Note on the tetrahedroid.'
5. DR. E. O. LOVETT: 'On the symmetry of algebraic surfaces.'
6. DR. G. A. MILLER: 'A generalization of Sylow's theorem.'
7. PROFESSOR W. F. OSGOOD: 'A new proof of the existence of a solution of the differential equation $dy/dx = f(x, y)$, the Cauchy-Lipschitz condition not being imposed.'
8. PROFESSOR JAMES PIEPONT: 'The Early History of the Galoisian theory of equations.'
9. MR. PAUL SAUREL: 'Note on integrating factors.'
10. M. JAMES MACLAY: 'Certain double minimal surfaces.'
11. PROFESSOR H. S. WHITE: 'Inflexional Lines, Triplets and Triangles Associated with the Plane Cubic Curve.'

The January number of the *Bulletin* (Vol. VII., No. 4) contains the following papers: 'On the Commutator Groups,' by Dr. G. A. Miller; 'On the Limit of Transitivity of the Multiply Transitive Substitution Groups that do not contain the Alternating Group,' by Dr. G. A. Miller; 'Geometry of Some Differential Expressions in Hexaspherical Coordinates,' by Dr. Virgil Snyder; a review of Lie's *Differential Equations*, by Dr. Edgar Odell Lovett; a notice of Beman and Smith's translation of Klein's *Vorträge über ausgewählte Fragen der Elementargeometrie*; 'Notes;' and 'New Publications.'

The February *Bulletin* (Vol. VII., No. 5) is a 72-page number. It contains an account of the recent annual meeting of the Society, by the Secretary; an account of the Evanston meeting of the Chicago Section, by Professor T. F. Holgate, Secretary of the Section; the presidential address, 'The Philosophy of Hyperspace,' de-

livered at the annual meeting, by Professor Simon Newcomb; 'Orthogonal Group in a Galois Field,' by Dr. L. E. Dickson; a valuable review of Weber's Algebra, by Professor James Pierpont; 'Shorter Notices; 'Notes;' and 'New Publications.'

GENERAL.

THE Romanes lecture of Oxford University will be delivered by Sir Archibald Geikie in the Sheldonian Theatre on June 1st, on 'Types of Scenery and their Influence on Literature.'

MR. F. W. DYSON, of the Royal Observatory, Greenwich, London, writes to the London Times that the photographs of the solar eclipse taken by the Astronomer Royal, Professor Turner, Captain Hills, Mr. Newall and Dr. Copeland have all been developed and that the results are excellent. Captain Hills has succeeded in photographing the spectrum of the reversing layer, and Professor Turner has obtained marked results as to the amount of polarization of the corona.

PROFESSOR HITZIG, of Halle, has been elected an honorary member of the London Neurological Society, in the room of the late Professor du Bois-Reymond.

It is reported in *Nature* that, after sixteen years as professor of geography at the Royal University of Turin, Professor Guido Cora has resigned his charge, in order to devote himself entirely to scientific researches in geography and related sciences. He has transferred his residence (and the direction of his periodical *Cosmos*) to Rome, Via Goito, 2.

THE physico-mathematical section of the Berlin Academy of Sciences has appropriated 700 Marks to Professor Fr. Dahl, of Kiel, for the arrangement of the zoological material collected by him in Ralûm; 500 Marks to Dr. Philipp Fauth, of Landstuhl, for the publication of drawings of the planets Jupiter and Mars, and 1,200 Marks to Dr. K. Holtermann, of Berlin, for the publication of a work on the fungi of the East Indies.

PROFESSOR EDMUND J. JAMES, of the University of Chicago, has been nominated by the Bureau of Education to represent the United States at the International Congress of Com-

mercial Instruction, to be held at Antwerp next April.

It is proposed to hold an International Industrial and Commercial Congress in Brazil, from May to October, 1899.

A CONFERENCE of representatives of the National and State Boards of Health to consider questions of general sanitation will probably be arranged in connection with the International Health Exposition, to be held at the Grand Palace, New York City, from April 25th to May 21st.

It has been decided to hold at Earl's-court, London, from May to October next, a universal exhibition intended to illustrate the inventions, industries, manufactures and applied arts of today. An endeavor will be made to render it international in its scope, and sections have been devoted to France, Germany, Russia, Austria-Hungary, Switzerland, Turkey, Bosnia and the United States. The exhibition will be the fourth of the series held at Earl's-court, under the management of the London Exhibitions (Limited).

THE Council of the Sanitary Institute of Great Britain has accepted an invitation from the Lord Mayor and City Council of Birmingham to hold its seventeenth congress and exhibition in that city in September next.

AN exhibition of the collections of the Jesup North Pacific expedition, made during the summer and autumn of 1897, will be opened in the American Museum of Natural History on February 15th. A lecture on the general results of the expedition will be given, at 3 p. m., in the museum.

MR. H. S. H. CAVENDISH, already known for his explorations in Somaliland, is about to start with a caravan of four hundred natives to investigate the country west and northwest of Lake Rudolf, in equatorial Africa.

MR. G. B. SUTTON, of Newark Valley, has presented to Cornell University a collection of the woodpeckers of North America, together with an oil painting representing a forest scene. The woodpeckers, representing 24 species and 11 sub-species, are mounted in natural attitudes upon an artificial beech stump, about 3.3 meters

in height, and are so arranged that they can all be seen at a glance. Mr. Sutton purposes giving to the University a group of nocturnal animals mounted in a similar manner.

A SERIES of specimens of rare coal taken from mines in Missouri, Arkansas and Texas, and a collection of petroleum, petroliferous rocks and petroleum shales from India have been presented to the museum of economic geology of New York University.

GENERAL LEW WALLACE has announced that at his death the city of Crawfordsville, Ind., will come into possession of his study, which has just been completed at a cost of \$40,000. The building is to be used as a public library. A collection of rare books will be included in the gift.

We take the following items from *Natural Science*: The association française de botanique has acquired as its organ *Le monde des plantes*, for many years edited by Mr. Lévillé, of Mans (56 Rue de Flore). The Association is intended to take the place of the Société française de botanique, which ceased to exist in 1895. It is intended to form a central herbarium and library, free to members, and to undertake the exchange and determination of specimens. The State Museum, Vienna, received the following collections during 1896: Eppelsheim collection of Coleoptera, including more than 2,000 species or 26,000 specimens of Staphylinidæ; the Gustav Mayr collection of Hemiptera, including 1,350 species or 5,500 specimens; the Bergenstamm collection of Diptera, including 3,000 species or 45,000 specimens; the Steindachner collection of fish, chiefly from the Red Sea, 3,400 specimens representing 702 species. The collection of geological photographs in this Museum then numbered 1,892, while the ethnographic photographs were 5,477. The Colonial Museum at Marseilles, opened in 1893, is remarkable for its valuable collection of tropical vegetable products. These are studied and analyzed under the direction of Mr. Heckel in the Museum laboratory. Among recent acquisitions may be mentioned Dr. Buisson's collection of the mollusca of Tahiti, botanical collections from New Caledonia, presented by Messrs. Heckel and Jeanneney and

Col. Pelletier, and from the Antiles by R. P. Düss.

THE January number of the *American Naturalist* has just been issued by Ginn & Company, being the first number to be issued under their imprint. The appearance of the journal is greatly improved, a heavy glazed paper being used, with wide margins and new type. The issue of the first number of the thirty-second volume, the first entire volume under the new management, is made the occasion of an editorial on the aim of the *American Naturalist*, the province of the journal being defined as follows: "May it not be possible to regard the earth and its inhabitants as a unit? Then the problem would be to describe the various parts of this unit and to explain their relations to one another. While the solution of this problem is too vast an undertaking for any one man or any generation of men, may it not be legitimate to adopt it as the final purpose of a journal which is intended to represent the great body of naturalists in this country? It seems to us that there is a legitimate ideal of attainment and one which, if kept steadily in view by editors and contributors, will afford that unity of purpose which is essential to success."

WE have received the first two numbers of the *Journal of Applied Microscopy*, edited by Mr. L. B. Elliott, and issued from the publication department of the Bausch & Lomb Optical Company, Rochester, N. Y. The first numbers contain contributions from several leading American zoologists, and the coöperation of about a hundred men of science, who use the microscope as an instrument, has been promised. In the introductory editorial the scope of the journal is defined as follows: "It will be a progressive record of new apparatus of every kind bearing on the operations leading up to and including the use of the microscope, improvements in apparatus and new applications of apparatus already existing, methods of working, new and useful formulæ, discussion of matters relating to the above subjects, digests of similar matter appearing in foreign journals, and news and notes about institutions and men here and abroad."

THE Duquesne Steel Works of the Carnegie

Steel Company have in a single day produced 204 'heats' in twenty-four hours, and 1,928 tons of ingot-steel in the converting and 1,700 tons in the finishing mill. This is said to exceed anything reported previously in the United States and to be vastly in excess of anything known in Europe.

ON motion of Senator Cantor, the Assembly resolution calling on the Representatives of New York State in Congress to secure the establishment of a national park on the Palisades of the Hudson was taken from the table by the Senate at Albany on February 9th and adopted. A bill designed to protect the Palisades from further injury was introduced into the House of Assembly at Trenton, N. J., on February 8th, by Mr. Marnell, the provisions of which are as follows: "Every person or corporation which shall, within a distance of 2,000 feet from any navigable river forming the boundary line of this State, explode or cause to be exploded, for the purpose of blasting, breaking or loosening rock, any high explosive, shall be guilty of a misdemeanor, and on conviction thereof shall be punished by imprisonment not exceeding one year, or by a fine not exceeding \$1,000, or both."

GOVERNOR BLACK, of New York State, advocates the passing of a bill that would lease to Cornell University for twenty-five years about twenty thousand acres of State land outside of the limits of the Forest Preserve. By the aid of an annual appropriation, which this year may be \$25,000, the University authorities would be enabled to engage in forest culture. The best methods of forest preservation and cultivation in France and Germany would be followed on this tract of twenty-five thousand acres. The trees would be trimmed at the proper time; 'ripe' trees would be cut down and sold, and young trees would be planted. The aim would be to make the tract a paying investment for the State. If this model forestry park should be a successful experiment, the same method of management could be applied to the eight hundred thousand acres of forest land the State now owns in the Adirondacks.

Natural Science asks: "How many copies of a printed book need be issued to constitute a pub-

lication? This question seems to be raised as a side issue in a paper by Mr. Davies Sherborn on Thomas Martyn's 'Psyche,' in the January number of the *Annals and Magazine of Natural History*. Mr. Sherborn states that only ten copies of the book were issued; and the names of the species were, with six exceptions, written in ink either below the figures themselves or on fly leaves. The fact that the names were not printed is sufficient for Mr. Sherborn to stamp them as manuscript, despite the fact that they have been used by entomologists. We wonder what entomologists will say. One interesting fact in connection with the matter is that the author of this paper had actually three out of the ten copies, side by side for comparison, and has been able to trace five out of the original ten. Mr. Sherborn does not mention the copy of Part I. in the Hope collection at Oxford, but that evidently falls under his 'specimen' copies, of which it is likely others may turn up. Now let us suppose this to be a printed book. What happens? Four entire copies of the original ten are in England, one is in Holland, the rest are unknown. What possible chance has an American or an Australian of seeing such a book? Without seeing it his work must be imperfect. We offer no decision of the difficulty ourselves, but think the point sufficiently interesting to call attention to it."

THE *Auk* for January contains, as frontispiece, the portrait of the late Charles E. Bendire, accompanying a memorial article by Dr. J. C. Merrill, presented at the 15th Congress of the American Ornithologists' Union.

DR. T. J. ROTHROCK, State Forestry Commissioner of Pennsylvania, states in his report to the Department of Agriculture, quoted from advance sheets from the *Public Ledger*, that while the rainfall last year was greater than in previous years the streams seem to have been lower. Dr. Rothrock considers that there can be no doubt but that in the periods of annual minimum water flow our rivers are delivering less water each year. Thus the most reliable statistics available show that in periods of least annual flow the water sent down by the Schuylkill river at Philadelphia in 1895 was only 39 per cent. of the amount available in 1816.

Three explanations may be offered: First, that we are passing through a period of less rainfall than formerly. Second, that the disastrous change is due to disturbing the former balance of natural conditions by removal of the forests. Third, that much of this missing water has been used before it reaches the point or points at which the estimates were made. It is on the second of these explanations that Dr. Rothrock lays the most weight.

MISS ORMEROD, of Torrington-house, St. Albans, has published her annual letter on insect pests in Great Britain. She mentions, according to the *London Times*, the damage done to grass and corn crops by wireworms, leather-jackets, chafer-grubs, and the caterpillars of the small swift moth. Hessian fly and corn sawfly were reported locally. Insect attacks upon orchard and bush fruits are becoming more numerous. The codlin moth, the apple sucker and the muscel scale were all troublesome, and there is at least a probability that the American 'apple grub' has obtained a foothold in English orchards. The wood of plum trees was tunnelled by shot-borer beetles, and the foliage of cherry and pear trees was ravaged by the small slug-like larva of the pear sawfly. The more conspicuous pests of timber trees is the 'timber-man' beetle and the elm-bark beetle. A matter of special interest is the risk incurred by a large importing country like England of bringing within its borders exotic pests which happen to infest produce grown abroad. Several illustrations of this are incidentally given by Miss Ormerod. Thus, the larva of the Angoumois moth was brought to England in barley imported from North Africa. The Mediterranean mill moth was found in flour shipped from an Adriatic port, and this exceedingly troublesome pest is undoubtedly establishing itself—it is to be feared permanently—in flour mills and flour stores. Locusts are present in considerable numbers in Lucerne hay from Argentina, and a case is mentioned in which three horses fed on such hay fell ill, but recovered when the hay was discontinued. The 'German cockroach' is making an apparently successful invasion of English kitchens. It is much smaller than the common cockroach, is yellowish or brownish in color, and striped with dark brown.

UNIVERSITY AND EDUCATIONAL NEWS.

THE report of President Eliot, of Harvard University, with the appended documents, makes a volume of some 376 pages. President Eliot lays special stress on the desirability of granting degrees in the middle as well as at the close of each academic year, urging that this would be of great importance to some classes of students. The votes of the corporation formally inviting the Massachusetts Institute of Technology to affiliate with Harvard University are given, readiness being expressed to make such modifications in the technical departments of Harvard University as may be desirable. It is suggested as of pressing importance that the medical school be removed to a new site, and that a hospital be erected as an adjunct to it. The income of the University apart from new endowments was \$1,327,360.57, while the payments were \$1,228,941.50.

THE regents of the University of California have decided to establish a college of commerce as one of the departments at the University. President Kellogg is directed to make application to the President of the United States that an engineer officer of the United States Navy be detailed, in accordance with the Act of Congress approved in 1879, to act as instructor in the college.

AT the recent meeting of the Board of Trustees of the University of Tennessee it was decided to erect a new building for the department of mechanics and two new dormitories. It was also determined to establish, in the near future, a separate school of economics.

BY the death of Miss Sara M. Fletcher, of Woodstock, Vt., \$6,000 is left to Dartmouth College, as provided by the late Richard Fletcher, of Boston.

THE sum collected for Vassar College through the efforts of its alumnae now amounts to \$90,000, of which \$50,000 will be devoted to the establishment of the Maria Mitchell chair of astronomy.

DR. GEORGE SANTAYANA, instructor in philosophy at Harvard University, has been appointed to an assistant professorship.

THE name of the Hon. Carroll D. Wright has been added to the faculty of Dartmouth

College as lecturer on the application of statistics to social and political science; George P. McKee has been appointed instructor in physics.

PROFESSOR CHARLES R. RICHARDS, director of the manual training department of the Pratt Institute, Brooklyn, has been appointed to the chair of manual training in the Teachers' College, Columbia University.

At the University of Cambridge, Mr. F. C. Kempson and Mr. R. H. Biffen, of Gonville and Caius College, have been appointed demonstrators of anatomy and botany respectively.

DISCUSSION AND CORRESPONDENCE.

WEATHER HARMONICS.

THE study of weather periodicity has, from the beginning of meteorology, attracted, more or less, the time and attention of students. Yet, so baffling and uncertain are the results so far produced that many have been led into the scepticism voiced by a recent writer, who remarks, 'There is, apparently, no periodicity in the recurrence of weather.' It seems to me, however, that this attitude is the same as that of a student who visited the track of a tornado, expecting to find the trees and other débris lying in perfect circles, but on finding the fallen trees lying over each other pointing in different directions, and other débris in tangled confusion, came back and announced his conviction that no whirl existed in the tornado funnel. In other words, my study of the subject for many years convinces me that it is the complexity of the data, not the absence of the phenomenon, which has induced this scepticism in regard to weather periodicity.

I am led to the conclusion, which is extremely important if true, that one of the complexities which has helped to obscure weather periodicity is the existence of what may, perhaps, be called weather harmonics, on account of the resemblance to harmonics in sound—that is, the existence of other periods related to the primary as 2, 3, 4, etc. In what follows I shall briefly outline the evidence on which this conclusion is based.

For the first examples I take the best known and only generally accepted cycles, the annual and daily periods. The first harmonic periods I wish to point out are multiples of a year,

namely, two, three, four and eight years in length, all of which are continuously acting, but now and then one becomes predominant, so that it may be selected for illustration.

Thus, over the interior of the United States there were for many years very marked oscillations of pressure, temperature and humidity covering a period of about two years. These were discussed in the *American Meteorological Journal*, Vol. I., pp. 130 and 528. The data appeared at first to indicate a period about a month longer than two years, but later investigation indicates that it is more exactly two years. Three and four-year multiples have not been marked in the United States, but an eight-year period has been well marked. Thus the Chief of the Weather Bureau gives, in his latest report (1897, p. 23), the years of widespread drought in the United States during the last forty years as follows, 1860, 1863, 1870-71, 1881, 1887 and 1894-95. An eight-year series, running as follows, 1863, 1871, 1879, 1887 and 1895, takes in four out of six droughts. This seems to have been acting with the eleven-year or sun-spot period, the maxima of which occurred about 1860, 1870, 1883 and 1894, and are apparently connected with droughts in the United States. In the British Isles during the last 50 years three, four and eight-year periods appear to have been equally active, hence no simple rhythm can be selected for illustration. But I desire to call attention to one striking fact. It is well known that harmonic sound waves, after a certain number of oscillations, occur with their like phases together, and form beats, and it might be expected that harmonic weather periods, if they exist, would likewise form beats. Since 24 is a common multiple of 2, 3, 4 and 8, extremes of weather would be expected to be separated by such an interval. Now, it is a curious fact that the curves published by A. B. MacDowall, showing the number of frost days at Greenwich, show very marked extremes at this interval. For example, the greatest number of frost days were in 1855 and 1879, 24 years apart, while the least number were in 1872, 1884 and 1896, separated by intervals of 12 and 24 years. (See *Meteorological Zeitschrift*, 1897, p. 384.)

I have reason to believe there are also periods

of a-half, a-third, etc., years, but these appear to be less marked than the multiples of years.

There are also weather periods which are even multiples of days. The most marked of these are 3, 4, 5 and 8 days. On account of limited space I can only illustrate one period, and because of accessible data I have selected the 4-day period. Taking the observations of temperature at 8 a. m. and 8 p. m., made at the Blue Hill Meteorological Observatory during 1895, and obtaining the departures from the normals, the residuals were classified into 4-day periods. The means of each six periods were then obtained and are given in the following table:

1895.	MEAN DEPARTURES IN DEGREES FAHRENHEIT.				
Jan. 20-Feb. 12	-3 -3	-1 +2	+3 +3	+2 -1	
Feb. 13-Mar. 8	+2 +2	0 -1	-2 -1	+1 +2	
Mar. 9-April 1	+2 +2	+1 -1	-1 -1	-1 +1	
Apr. 2-April 25	+2 +1	-2 -2	-1 +1	+2 +3	
Apr. 26-May 29	+3 +1	-2 -3	-3 -1	+3 +4	
May 30-June 12	+2 +3	+2 +1	-1 -2	-2 -1	
June 13-July 6	0 +1	0 0	0 -1	0 +1	
July 7-July 30	0 +1	0 +1	+1 +1	0 0	
July 31-Aug. 23	0 0	-1 0	0 -1	0 +1	
Aug. 24-Sept. 16	+3 +1	0 -2	-2 -1	+1 +2	
Sept. 17-Oct. 10	+2 +3	+2 0	-2 -2	-1 0	
Oct. 11-Nov. 3	+2 +3	+2 0	-1 -2	-2 0	
Nov. 4-Nov. 27	+2 +1	-1 -2	-1 +1	+2 +2	
Nov. 28-Dec. 21	+1 +3	+2 +1	-1 -2	-2 -1	

This table shows that throughout the year plus departures are found on the first day of the period, with but one exception; while on the third day, out of twenty-eight recorded means, twenty-one were minus departures. This period, has continued equally well marked and mainly with the same phase during the last three years. The range of temperature in the period is about four degrees, while the mean daily range of temperature from hourly records at Blue Hill is about 10° F. Under certain conditions there is a semi-diurnal oscillation in the temperature (*Annals of Harvard College Observatory*, Vol. 20, p. 123).

One further illustration will be sufficient, perhaps, to show the universality of the harmonic law. For this I have selected the 22-year or double-sunspot period. Mr. R. C. Mossmann gives a table in the *Transactions of the Royal Society of Edinburgh*, Vol. XXXIX., p. 187, showing for Edinburgh the departures of temperature from normal, from 1764 to 1896, smoothed by continuous five-year groups. These means

show little or no trace of an eleven-year period, but in Mr. Mossmann's plotted curve of the annual means show six distinct waves of a length of about 22 years. Thus the minima of the waves occurred as follows:

Observed Minima	1772	1784	1815	1838	1860	1879
22-year cycle	1771	1793	1815	1837	1859	1881

With the exception of 1784 these dates differ but little from that of an exact 22-year cycle, and approximate very closely the dates of minimum in the same cycle in New England, in Iceland and in Paris (*Nature*, Vol. 51, p. 436). The annual averages in Mr. Mossmann's table were classified into six periods of 22 years, beginning with 1766, and averages were obtained from each year of the cycle. These, in tenths of a degree Fahr., are as follows:

Year of cycle	1	2	3	4	5	6	7	8	9	10	11
Means	+2	+3	+1	-1	-3	-6	-6	-6	-3	-1	+1
Mean error ±	5	7	7	6	5	4	5	4	5	3	3
Year of cycle	12	13	14	15	16	17	18	19	20	21	22
Means	+2	+3	+7	+5	+6	+6	+2	+1	+0	+1	+1
Mean error ±	3	3	4	2	1	2	2	4	3	5	3

These means show a well marked period, and at the epochs of maximum and minimum the means are considerably larger than their mean errors. At the time of maximum, between the 14th and 17th year of the period, the means are nearly three times as large as their mean errors, an unusually favorable showing in the case of a meteorological cycle. Dr. Schreiber's curves of the eleven-year period in rainfall, published in the *Abhandlung des Königl. sachs. meteorologischen Institutes*, Plate IV., show that the eleven-year period at Dresden and Freiberg is made up of two primary waves of nearly equal magnitude and two secondary waves midway between the primary.

The harmonics in the case of periods of other lengths were pointed out in the *American Journal of Science*, Vol. XLVIII., p. 231. The application of these weather cycles to forecasting is interfered with: (1) by the multiplicity of the cycles and their independent variations in amplitude according to some unknown law; (2) the oscillations of the cycles (including the annual and daily cycles) simultaneously in different phases in different parts of the world (see *American Meteorological Journal*, Vol. I., p. 528); (3) the sudden inversion of the phase

of the cycle from time to time at any one point on the earth's surface. Number (3) appears to be true for every cycle except the annual and diurnal cycles, and is the most difficult and confusing condition that confronts the believer in weather cycles. The formula

$$\sum \frac{\cos \pi x}{n^2 - x^2}$$

is a mathematical expression of the sudden inversion of phase which may take place in harmonic curves, as is beautifully shown by Professor Michelson's harmonic analyzer. Whether this, however, has any relation to weather curves is uncertain.

I feel strongly that the difficulties will in time be solved, and that forecasting by means of weather cycles will supplant largely, if not entirely, all other forms of weather forecasting.

H. HELM CLAYTON.

BLUE HILL METEOROLOGICAL OBSERVATORY,
HYDE PARK, MASS., February 8, 1898.

SCIENTIFIC LITERATURE.

The Ruins and Excavations of Ancient Rome. A Companion Book for Students and Travelers. By RODOLFO LANCIANI. Boston and New York, Houghton, Mifflin & Co. 1897. Small 8vo. Pp. xxiv+619.

This book will be a godsend to the more intelligent class of English-speaking travelers, who are not obliged to limit themselves to a very short stay in Rome. Few, indeed, are the persons who have not felt somewhat bewildered when they have been called upon to map out their time for a winter in the Eternal City so as to use it to the best purpose.

The ordinary guidebook, no matter how good it may be, is not enough; Middleton's 'Ancient Rome,' which is in many ways almost indispensable, is written largely from an architect's point of view; the various German works are for the most part intended more for professional students of antiquity, and Professor Lanciani's other two books, 'Ancient Rome in the Light of Recent Discoveries' and 'Pagan and Christian Rome,' are of too popular a character to be very useful, if a person wishes to undertake a serious, albeit a not strictly professional, study of the ruins of the city. There was,

therefore, need for just such a book, which should cover substantially the whole field and which should include the most recent results of Roman topographical investigation, as the one before us. Its usefulness will, however, by no means be confined to intelligent travelers, for, to quote from the preface, 'students wishing to attain to a higher degree of efficiency in this branch of Roman archaeology (viz., topography) will find copious references to the standard publications on each subject or part of a subject.' Indeed, the skill with which Professor Lanciani has constantly kept in mind the needs of these two classes of readers, without thereby spoiling the unity of his book or making it unfit for either class, is worthy of high praise. The enormous mass of material which must be handled in any treatment of Roman topography has been arranged and presented with simplicity and skill; questions in dispute have been indicated without lengthy discussion, and thus the dryness so characteristic of works in which the statement of a very large number of facts is necessary has been in a great measure avoided.

In Book I. of his work, which contains 'general information,' Professor Lanciani has gathered together a large amount of material that is not easily accessible. The geological formations about the city, the climatic conditions, the quarries, the bricks and the Tiber are discussed. The walls in different periods, the bridges, the aqueducts, the *cloacæ*, the regions of Augustus and the maps of the time of Severus—what might, in fact, be termed the anatomy of the city—are also treated here. Some interesting statistics, too, in regard to population and the amount of the water supply have been included. Books II. and III. are concerned with the very heart of the city—the Palatine Hill and the Sacra Via from Coliseum to Capitol—and here is included also the discussion of the Forum Romanum and of the adjoining *fora* of imperial times. In book IV. the rest of the city is described according to the Augustan Regions and there is a brief concluding chapter on the 'general aspect of the city.' This is followed by an appendix containing lists of the Emperors, Popes and artists and useful information touching chronology, weights and

measures, etc. There are also two classified indexes, but no general one.

No attempt can be made here to review with any real thoroughness this important and interesting contribution to the ever fascinating study of Rome. One or two special points of excellence, however, may be noted and a few rather trivial defects pointed out which might easily be remedied in another edition.

The student will be glad to have in a work so readily accessible as this book is the discussion of the earliest settlement on the Palatine in the light of the excavations at Antemne and at Castellazzo di Fontanellato. No doubt deeper excavations are necessary before any clear idea of the pre-historic settlement in Rome can be gained; yet, with a knowledge of the lay of the land and of the settlements which must have had many points in common with that on the banks of the Tiber, the beginnings of the city are removed from the domain of pure speculation. It is pleasant, too, to note that a rational explanation of the dark rooms in Caligula's palace may now be read by the visitor to the Palatine, and that he will no longer be asked to believe that the beautiful decorations were never seen except by artificial light. It is, however, to the account of the Pantheon, the most impressive structure in our heritage from ancient Rome, that the average reader will turn with keenest interest. Doubtless many knotty questions about the building have not been and perhaps never will be solved, but the most recent and very important studies of it have developed the cardinal fact that the present structure dates from Hadrian and is not Agrippa's at all. Agrippa's structure was probably of a different shape and faced south instead of north. It appears to have looked out on a circular open space which was paved and which was enclosed by a wall that is concentric with the foundations of Hadrian's Pantheon. Unfortunately, it is still a mystery what the relation of the building to the thermæ was. Lanciani's account of this complicated architectural problem is a model of clear, simple statement, quite free from the vice of claiming results which it is not possible to prove.

It would be easy, if it were worth while, to extend in detail an enumeration of the many

excellent features of this handbook, but it is not so easy to discover its defects, which at best are insignificant. In the first place there should be a good map of modern Rome in the book. The lack of this is occasionally an annoying omission, as an attempt to follow out carefully the account of the bridges, pp. 16 ff., will show. A new general map of the Palatine would be an improvement. Many students of Greek sculpture will quarrel with the positive attribution of the 'Venus Genetrix,' p. 301, to Arcesilaus, and they will miss, p. 415, a reference to the publication in the *Antike Denkmäler* of the remarkable relief on the marble throne of the 'Venus Sallustiana.' Very welcome, however, is the publication of the beautiful Greek head on p. 177.

The English of the book is simple and clear, with almost no traces of foreign influence. On pp. 62 and 104 'designs' and 'designed' are not used in accordance with our idiom. 'Hexedra,' p. 176, can hardly be justified, and the spelling 'Polykletos,' p. 215, is rather a flagrant example of the confusion we have fallen into in the transliteration of classic names. The German 'Poebene,' p. 115, even in quotation marks, is scarcely better than Valley of the Po or Po Valley, and it is questionable whether 'unities' (*oncies*) of water, p. 184, will be readily understood.

The publisher's work has been well done, though the volume is heavier than one could wish. There is a trifling misprint in 'tribute (sic) of the plebs,' on p. 117.

J. R. WHEELER.

Les Cécidomyies des céréales et leurs parasites.

By DR. PAUL MARCHAL. *Annales de la Société Entomologique de France*, Volume LXVI. 1897. Pp. 1-105; Plates I.-VIII.

This paper, which has just come to hand, is, taking it all in all, the most important contribution to a knowledge of the Hessian fly in Europe which has ever been published. It contains also studies of a very great biologic interest, especially with regard to the larval development of certain of the parasites of the larva of the Hessian fly, and it is especially in relation to these observations that this review is submitted. Dr. Marchal has studied carefully the life history of *Cecidomyia destructor* in

France, his attention having been called to the species by extensive damage in the Vendée during 1894. He shows that, although previous writers in many countries have given three as the maximum number of annual generations, in France there may be developed, under the most favorable circumstances, six such annual generations. The most part of these, however, are partial, and the most incomplete are the third, fourth and sixth. He has shown that there is a considerable retardation of development where humidity is lacking, dryness having been responsible for a retardation of two months. An interesting section on natural selection concludes with the statement that, far from being adapted to climatic conditions by natural selection, the species is perpetuated in spite of obstacles placed in its way by exterior conditions, and that it overcomes these obstacles only by its fecundity and by the great variability of its biologic cycle. Careful studies are given of other species of Cecidomyiidae affecting grasses and grains in Europe and elsewhere, and especially of *Cecidomyia avenae*, a closely allied form which the author has differentiated from the Hessian fly.

The observations made on the biology of parasitic insects are nothing less than remarkable. The larval development of internal feeding insect parasites is, of course, very difficult to observe. Few observations of value are recorded. The well known studies of Ganin on certain Platygasters were the earliest. The studies by Bugnion on the structure and life history of *Encyrtus fuscicollis*, an internal parasite of the European *Hyponomeuta cognatella*, are the only ones of importance which have appeared since Ganin. All of the species of the genus *Trichacis* are parasitic within the bodies of Cecidomyiid larvæ, and the genus is closely related to the form studied by Ganin. According to Marchal the first larval form of *T. remulus* corresponds to the type of the curious cyclops-like larvæ studied by Ganin, and which certain authors regard as an adaptive form, while others see in it an ancestral form. The post-embryonic development, according to Marchal, is as follows:

When they are young and motionless, and have not issued from the cysts which contain

them, these larvæ are always lodged in the interior of the nervous system of the host larva, and there they bring about alterations and proliferations of a very curious character. The most frequent is at the posterior extremity of the nerve chain, where the cyst of the parasite is formed. This extremity spreads out into an enormous bouquet of club-shaped giant cells, which alone fills the larger part of the body cavity of the host. The larva of the parasite is lodged in a cyst filled with liquid, the cellular structure of which, with broad, polygonal contour, seems to indicate an amniotic envelope in a condition of retrogression. All around this membrane the giant cells are grouped. These exist not only in the immediate neighborhood of the cyst, but all the surrounding region of the nerve chain seems to have undergone the same degeneration and growth of giant cells. The youngest cells are hyaline and present a fibrillous, longitudinal structure. The oldest cells are filled with fatty globules and become entirely opaque. The giant cells increase and isolate vesicles, which separate and fall into the body cavity in the form of protoplasmic spherules, which are absolutely characteristic. When one dissects a Cecidomyiid larva under the microscope he can be sure, if he sees these spherules floating in the liquid, that there are in the preparation one or more larvæ of this parasite. The localization of the larvæ of the *Trichacis* in the nerve chain or in the nerves of the larva presupposes that the parasite pierces the egg or the young larva upon the median ventral line at the time when the nervous system has not begun to branch and is concentrated in a single ventral band. The mass of giant cells accumulate in themselves evidently the nutritive material necessary to the parasite. They are a kind of internal animal gall, developed by the presence of the parasite. The *Trichacis*, in the condition of the cyclops-larva, waits in its cyst until the tissues which surround it have submitted to the transformations by which it profits later for its food; then, when the host larva, exhausted by its presence, is transformed into a sort of a sac filled with giant cells, it issues from its cyst to devour the accumulated material, which, probably, has nutritive qualities

nearly identical with those of the vitellus. After undergoing successive transformations into three larval forms the adult insect finally issues from the puparium of its host, only one adult finally making its appearance from an individual puparium, although in the cyclops stage four larvæ may be present. There seems, in this first stage, to be a physiological competition between *Trichacis* larvæ, only the oldest surviving to take on its second stage. An interesting point is that there appear to be definite molts from the first to the second and from the second to the third stage, and that the dead bodies of the cyclops larvæ which succumb do not interfere with the development of the survivor.

Careful observations have also been made with an allied parasite, *Polygnotus minutus*. The larvæ of this species, instead of being localized in the nervous system, as are those of the *Trichacis*, are found in the gastric sac, where there are found a number of 10 or 12 grouped together, developing simultaneously, and all, or nearly all, destined to reach the adult condition. The group of young larvæ forms a mass situated in the interior of the stomach. It is surrounded by a hyaline and, perhaps, adventitious membrane. Each parasitic embryo is also surrounded by a membrane of its own. The larva is elliptical, somewhat attenuated at its posterior extremity, and provided with rather well developed mandibles. They fill the gastric cavity, which is generally distended. The second and third larval forms follow. The host is almost entirely devoured and reduced to a cutaneous sac. When ready for pupation they occupy the entire body cavity of the host, the skin being distended and showing by impressions the positions occupied by the contained parasites, thus appearing full of minute cocoons.

It is strange that a field of such great biologic interest as the development of these insect parasites has been neglected to a striking extent. The difficulties which once surrounded the technique of such studies have been brushed away by the discoveries of modern morphologists, and a great field is open to the first well equipped worker who cares to enter it.

L. O. HOWARD.

L'Année psychologique, 3me Année. Publiée par M. ALFRED BINET. Paris, Alcan. 1897. Pp. 825.

The three years of this annual have now made for it an established place among psychological journals, and furnish gratifying evidence of the introduction in France of sound laboratory methods in dealing with all phases of mental activity. M. Binet has established at the Sorbonne a laboratory where the abnormal and the startling, so closely associated with French psychological research, do not constitute the main field for investigation, but where problems more nearly approaching those of most other psychological laboratories awaken chief interest and receive valuable contributions toward their solution. The present number confines its original contributions, of which a brief analysis is given below, more strictly than before to the announcement of results of research at the Sorbonne, and gains thereby a decided advantage in reduction in size. One of the main interests of this laboratory at present is evidently the problem of the relation of blood-circulation to mental process. Its discussion occupies more than half the pages devoted to original matter. The problem is one of large importance to psychology, and it is being materially advanced, both as to method and as to established facts, by such work as is here reported. In addition to its original articles the *Année* contains as usual careful analyses of the psychological literature of the year (pp. 335-688), and the bibliographical index of *The Psychological Review*.

(1) *L'abstraction des émotions* (Pp. 1-9): TH. RIBOT. Abstract emotions can exist to a very limited extent. They are formed by the combination of characteristics common to various particular emotions, without losing wholly their true affective tone. Such terms as: 'spirit' of a country, of a place, of an opera, etc.; 'moral environment,' and 'moral atmosphere,' express such a condensation of emotions. Other examples are found in certain æsthetic works, especially those of the symbolists.

(2) *Les changements de forme du pouls capillaire aux différentes heures de la journée* (Pp. 10-29): BINET and COURTIER. Many variations exist in the form of the capillary pulse in dif-

ferent individuals and under different conditions. But one fact remains constant: Under the influence of a meal there occurs an acceleration of the heart, an augmentation in the amplitude of pulsation, and a lower position of the dirotism. As the hour of the meal grows more distant the heart works more slowly, the amplitude of pulsation decreases, the dirotism mounts toward the summit of the pulsation and tends to diminish or disappear. These phenomena are not due to the changed temperature of the hand alone, and are seen in the pulse of the wrist and of the carotids, as well as of the capillaries. They are doubtless intimately related to the sense of well-being, expansion and force which follows a moderate repast.

(3) *Les effets du travail musculaire sur la circulation capillaire* (Pp. 30-41): BINET and COURTIER. Local and fatiguing muscular exercise produces a weakening of the dirotism, a blunting of the point of the pulsation, a tendency toward displacement of the dirotism toward the point. General and moderate muscular exercise lowers and accentuates the dirotism and sharpens the point of pulsation. General and fatiguing exercise weakens the dirotism without displacing it toward the summit.

(4) *Effets du travail intellectuel sur la circulation capillaire* (Pp. 42-64): BINET and COURTIER. Short and energetic intellectual effort produces an excitation of the functions, vaso-constriction, acceleration of the heart and respiration, followed by a slight slackening of these functions; also in certain subjects, weakening of the dirotism. Intellectual work lasting several hours with relative immobility of the body diminishes the heart's rapidity and the peripheral capillary circulation.

(5) *Influence de la vie émotionnelle sur le cœur, la respiration et la circulation capillaire* (Pp. 65-126.): BINET and COURTIER. In most persons every emotion produces a vaso-constriction, an acceleration of heart and respiration, and an increase in amplitude of the chest; and the more intense the emotion, the more marked are these effects. In a few rare cases a sensation of pain and an emotion of sadness very slightly lessened the rapidity of the heart. It is possible, as was shown by observation of one subject es-

pecially, that the form of the capillary pulse changes with the *quality* of the emotions—a fact which may some time make possible a classification of emotions according to their physiological effects upon the form of the pulse.

(6) *Influence du travail intellectuel, des émotions et du travail physique sur la pression du sang* (Pp. 127-183): BINET and VASCHIDE. An improved form of the sphygmomanometer of Mosso was used to indicate the relative, though it did not give the absolute, measure of the blood pressure. This was found to increase under the influence of all the excitations mentioned above. The most intense effect was produced by physical work; spontaneous emotions came next, and the least intense effect was given by intellectual work. As the capillary pulse seemed to be intimately related to the quality of emotions, so the pressure of blood may prove to furnish a measure of the quantity (or intensity) of mental phenomena.

(7) *Enquête sur les premiers souvenirs de l'enfance* (Pp. 184-198): V. and C. HENRI. A series of questions was published in various reviews in 1895, to which 123 answers have been received. The first memory may be of an event occurring as early as the age of six months, or as late as eight years; the large majority correspond to the age of two to four. Other interesting details are given, and a further pursuit of the enquiry is promised.

(8) *Sur la localisation des souvenirs. La localisation dans les expériences sur la mémoire immédiate des mots* (Pp. 199-224): N. VASCHIDE. Series of words were read, 8 to 20 in number, and the subject was required to indicate the position of each word in the series. The main results were these: (1) There is not one single method of localization, but several differing greatly from one another. (2) These methods do not all of them depend essentially upon the memory; some depend on reasoning; and in many cases, where the localization is made by memory, reasoning directs or controls the task. (3) The localization is not made always, as has been supposed, by association, or, in other words, by reference to certain 'points de repère.' That is only one form, the mediate form. Some localizations are direct, immediate.

(9) *Nouvelles recherches sur la localization des sensations tactiles. L'expérience d'Aristote* (Pp. 225-231): V. HENRI. If two fingers are crossed and their ends touched by the two points of a compass, then the further removed from one another the two points actually touched, the nearer they will seem; and the point actually to the left will seem to the subject to be toward the right, and *vice versa*. If in this position of the fingers a single point of one finger be touched, it will be mistaken for the corresponding point of the other finger. Previous theories of tactile localization cannot explain these facts, and a discussion of their explanation is reserved for a later paper.

(10) *Étude sur le travail psychique et physique* (Pp. 232-278): V. HENRI. This paper is a contribution to the study of 'individual psychology.' Two factors enter into all work, whether mental or physical: *voluntary effort*, for the measure of which no sufficient test yet exists; and *attention*. The following tests are suggested for the study of the constancy and variations of the latter: (1) a series of discriminative reactions; (2) mental calculations, multiplication being preferable to addition; (3) writing to dictation as rapidly as possible; (4) learning by heart series of twelve numerals, and noting the number of repetitions necessary, and the number learned after each five minutes. Each of these tests shows results differing greatly with different individuals. Beside these general factors other special factors enter into particular kinds of work. Physical work depends especially upon *motor ability* or *skill*, for whose testing no thoroughly good test has been suggested, and *muscular power*, best studied by determining the manner in which an individual becomes fatigued. For this purpose Kräpelin's modification of Mosso's ergograph is well suited. For methods of determining the factors entering into mental work Henri refers to the article published by him and Binet in the previous review. He further shows the importance to pedagogy of these researches on mental and physical work, and finally presents, with some detail, the results attained by previous investigators in this field, and gives a bibliography of the subject.

(11) *Réflexions sur le paradoxe de Diderot*

(Pp. 279-295): A. BINET. Diderot claimed that a great actor does not experience the emotions that he depicts, and supported this contention by several arguments. Binet questioned nine actors in regard to this, and all replied unanimously that an actor always feels more or less the emotions of his character. Binet analyzes this artistic emotion and also the complex state of consciousness, at once emotional and critical, of both actor and spectator.

(12) *Psychologie individuelle—La description d'un objet* (Pp. 296-332): A. BINET. Binet here again insists upon the importance of the study of the higher mental processes as a means for making advance in individual psychology, and describes in detail one such test. In studying younger children he had them give a description, from direct observation or from memory, of a photograph presenting a number of details. He notes the length of the descriptions, the amount of simplification (an average of only two-fifths of the objects presented in the photograph were described, and in passing from perception to memory one-third of the objects were forgotten), the kind of objects selected for description and the associations with the memory of the fable of which the photograph was a representation. He compares children of different ages, and finds that he can divide the individual children into four types, as follows: (1) the descriptive type, describing only objects, and especially their prominent characteristics, without attempting to seize their significance; (2) the observing type, fixing their attention especially on the subject of the scene, judging and interpreting what is perceived; (3) the emotional type, attaching emotional terms to the objects described (but this type is not necessarily emotional in ordinary life); and (4) the erudite type, who, in place of describing the picture, express their knowledge of its subject.

Binet applied the test also to older persons, placing before them, as object for description, a cigarette. He finds here also four types, identical with the above, with the exception that the emotional type does not appear; and a fifth is described: the idealistic, imaginative and poetic.

E. B. DELABARRE.

BROWN UNIVERSITY.

SOCIETIES AND ACADEMIES.

BOSTON SOCIETY OF NATURAL HISTORY.

The Society met January 19th, thirty persons present.

Dr. G. H. Parker described a double-mouthed *Metridium marginatum*. The characters and the two types of internal structure shown in the normal form were described and compared with *M. dianthus* and allied species. Specimens with two discs were estimated to occur one in 700. The habits of the young were noted, and a detailed description of the two-mouthed specimen given. Fission probably takes place in the young specimen; both œsophageal tubes are entirely distinct; all but one pair of mesenteries are non-directive; division takes place through the endocoels; longitudinal fission, through the later stages, was considered probable.

Mr. B. H. Van Vleck said that he had found specimens of *Metridium* with two discs rather more frequently than Dr. Parker's experience indicated; he had seen, perhaps, 12 or 15, and considered their numerical proportion about one in 200 or 300.

Mr. G. M. Winslow spoke of an abnormal *Amblystoma*. The embryo showed a supernumerary joint behind and below the left hind leg; the abnormal cartilages are separate from the normal cartilages; the muscles were described; the alimentary canal has a number of blind tubules; the arteries are contracted; the veins can be traced. The abnormal pelvic girdle is closest to the 14th vertebra.

Professor C. S. Minot discussed the morphology of the true kidney. In vertebrates there are three distinct organs called kidney, the head kidney, the middle kidney and the true kidney; two of these may occur in the life-history of a single vertebrate. In structure the three differ at all periods. There are two views concerning the development of the true kidney; it may be due to embryonic connective-tissue, or to an actual outgrowth of the walls of the duct; in the pig the evidence obtained is not conclusive. The true kidney is fundamentally different from its predecessor; the head and middle kidneys are without capillary organs; they may be placed in one class, and the true kidney separated into another class. Dr. Minot drew attention to the specimens illustrating his

studies, and also to a preparation showing a symmetrical picture of the optic nerve of *Pimelodus*.

Dr. Parker showed an embryo kitten prepared to show the centers of ossification; after removing the viscera, the specimen had been subjected to alcohol, potash, water and glycerine.

SAMUEL HENSHAW,
Secretary.

PHILOSOPHICAL SOCIETY OF WASHINGTON.

The 479th meeting of the Society was held Saturday evening, February 5th. The first address was by Professor H. W. Wiley on 'Useful Bacteria.' Professor Wiley said in substance: In one sense nearly all bacteria may be regarded as useful. The following remarks, however, apply to those which are useful in agriculture. The growing of our crops depends upon the activity of bacteria in the soil. Especially is this true in respect of their supply of nitrogenous food. The higher vegetables, as a rule, eat only nitric nitrogen, while the original conditions in which nitrogen enters the soil is largely in an organic-form, totally unsuited to nourish plants. The nitro-organisms, which are the cooks and prepare the food of plants, belong to three classes: First, those bacteria, molds and yeasts which act upon organic nitrogenous matter and convert it into ammonia; second, those bacteria which act upon ammonia and convert it into nitrous acid; and third, the bacteria which convert the nitrous into nitric acid. The soil also contains ferments which are capable of oxidizing the free nitrogen of the air and converting it into forms suitable for plant food. It has been supposed that these bacteria live chiefly in symbiosis with leguminous plants and in nodules which are found on their roots. It is probable, however, that leguminous plants furnish simply the most favorable environment for the growth of these bacteria and that they may be able to convert free nitrogen into nitric acid entirely independent of other plant life. It may be, however, that there are two classes of organisms of this kind, one oxydizing free nitrogen in symbiosis and the other independently. Advantage is taken of this character of bacteria to cultivate them in a pure state and supply them in small bottles for fertilizing pur-

poses. The bacteria thus prepared are mixed with moist soil and, when they have propagated sufficiently, this soil is spread upon the field and thus the proper fertilizing ferments are introduced into the soil.

The second exercise was a paper by General Geo. M. Sternberg on 'Pathogenic Bacteria.' General Sternberg, in his paper, gave a general account of the modes of action of pathogenic bacteria and of the different channels of infection. He dwelt upon the fact that infection depends upon the degree of virulence of the pathogenic microorganism, upon the number introduced, and upon the susceptibility of the individual exposed to infection. This susceptibility depends upon inherited predisposition, upon reduced vital resisting power due to various depressing agencies, such as malnutrition, fatigue, mental depression, etc., and in certain cases upon a direct exciting cause, such as exposure to cold.

Localized infections were then discussed, including boils, abscesses, wound infection, erysipelas, pneumonia and diphtheria. Some account was also given of general blood infections (septicæmias), and of the pathogenic action of bacteria which multiply in the alimentary canal, producing toxic substances, which, being absorbed, give rise to more or less fatal forms of diseases, *e. g.*, cholera infantum, Asiatic cholera, etc.

The last paper of the meeting was by Mr. E. A. de Schweinitz, on 'Toxins and Antitoxins.' No abstract of this address has as yet come to hand.

E. D. PRESTON,
Secretary.

TORREY BOTANICAL CLUB, DECEMBER 14, 1897.

THE first paper, by Professor Francis E. Lloyd, 'On an Abnormal Cone of *Pseudotsuga taxifolia*,' discussed the inner scales of a cone recently observed on a leader of the Douglas Spruce. He figured and described certain lateral expansions of the primitive scale, remarking that, although of a stipular nature, they are exceptional in their absence of vascular tissue. In the abnormal cone the absence of these expansions from all but the inner scales suggested several lines of explanation, which

were discussed in some detail and with the promise of further elaboration.

Remarks were made by Judge Brown, Dr. Rusby and Mr. Howe.

Dr. Underwood commended Mr. Lloyd's attempt to secure phylogenetic evidence from the leaves of seedlings, and spoke of the great difficulty of securing such evidence from the external organs of plants, changing so rapidly as they do because exposed to the immediate action of their environment.

The second paper, by Mr. E. O. Wooton, 'Botanizing in New Mexico during the Summer of 1897,' gave an entertaining and graphic narrative of this collecting trip made by Mr. and Mrs. E. O. Wooton in Dona Ana and Lincoln counties, N. M., in last June, July and August. The route extended from the Rio Grande valley, at Mesilla, near the Mexican line, at an elevation of 3,900 feet, to Sierra Blanca Peak, at 11,000 feet. Special interest attached to the collections made from the southern end of the White Sands, a region about 30x6 miles or more in area, not before explored by a botanist, except that a half dozen plants had been gathered on its margin by Professor T. D. A. Cockerell, of Mesilla. This vast expanse of sand, seeming like a sea of white, is moving slowly to the east. Even its lizards are white. Several new grasses were obtained here, and other very peculiar species. Very extensive collections were made in this trip, though in the midst of great hindrances from the summer rains.

Discussion brought out the great dissimilarity existing between neighboring floras in New Mexico. Mr. Wooton's collections numbered about 30 sets of as many as 450 species (with perhaps 150 species more in parts). Mr. A. A. Heller, collecting meanwhile about 250 miles northward, among 300 numbers had but about 50 duplicates. Dr. Rusby, collecting sometime ago at a similar distance west, among 450 species had also but about 50 duplicates.

Further remarks were made by Professor Lloyd regarding his collections in Chihuahua, and by Dr. Rusby in commemoration of remarkable kindness received when destitute in the desert and conferred by Professor E. L. Greene.

EDWARD S. BURGESS,
Secretary.

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Harrison Allen